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Electrical World

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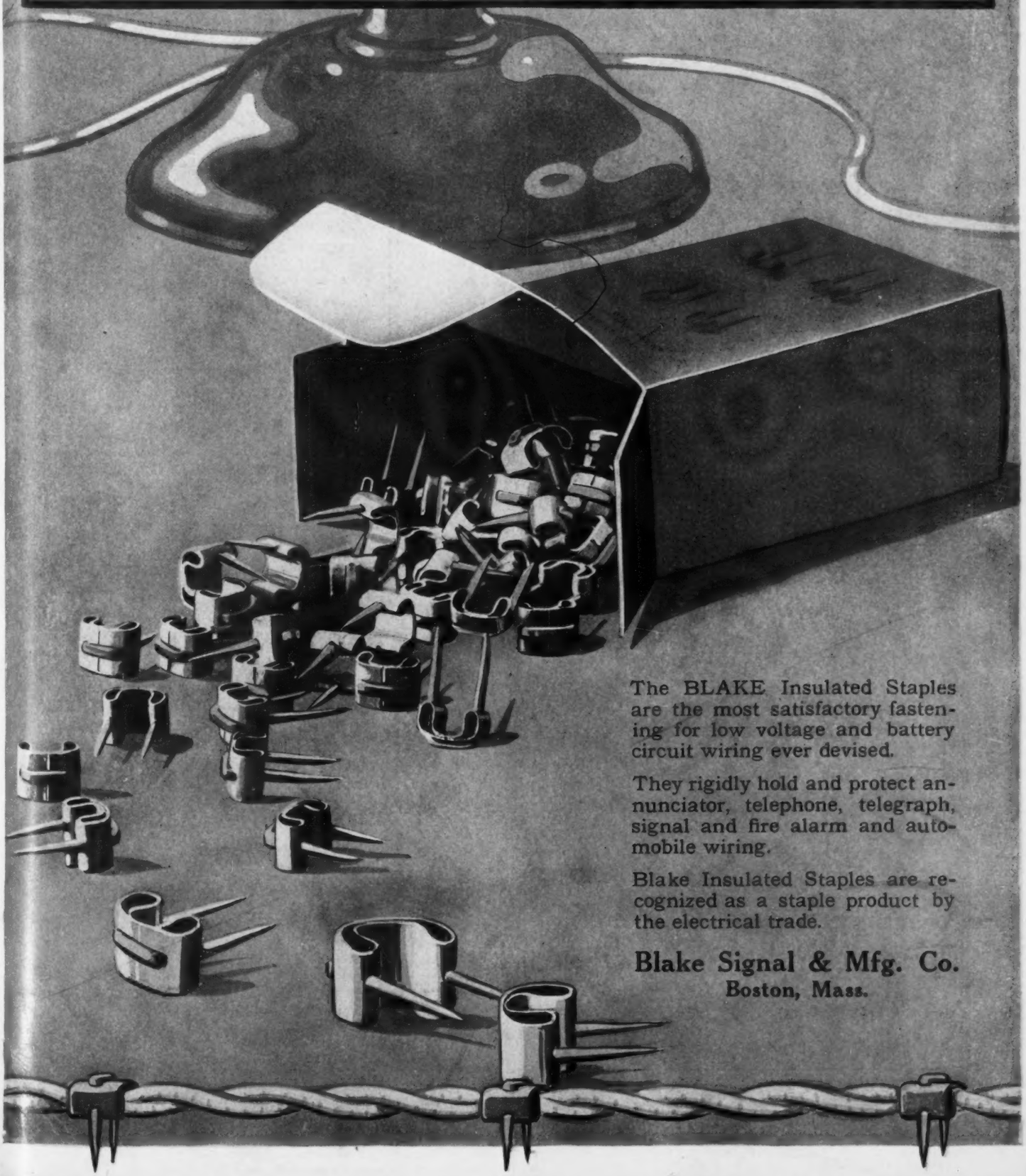

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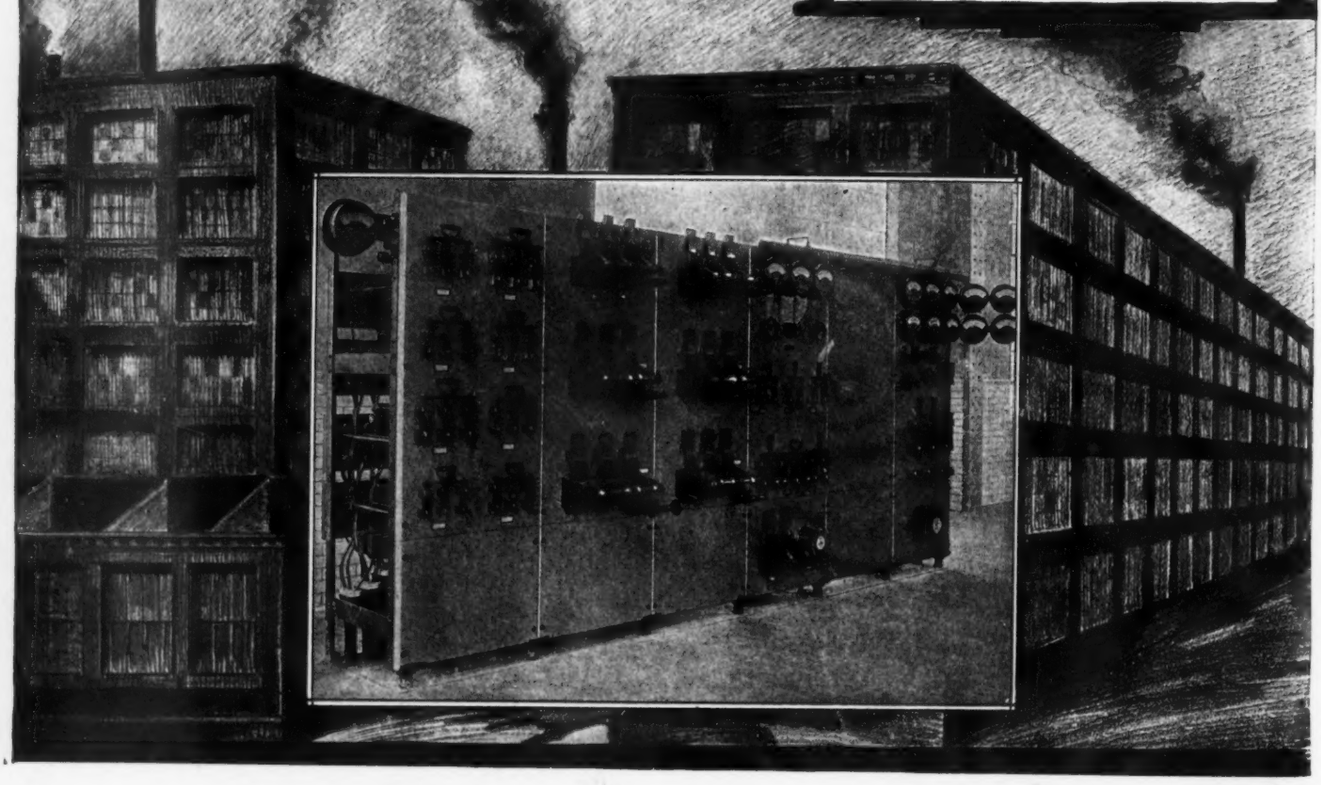


Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 75 New York, Saturday, February 21, 1920 *Number* 8

Well Put

THAT was a happily expressed idea to which utterance was given at the recent Conference Club meetings—that co-operation in the industry had in the past been hampered by suspicion and fear—suspicion of the other fellow, who must be "getting something out of it," and fear of getting into jail under the operation of rigorous anti-combination laws. There are signs of a coming era of good feeling when both the suspicion and the fear will vanish.

How Radio Can Help

THE extension of interconnection programs into realized operating schemes puts a strain upon intercompany telephone facilities which deserves careful investigation. The policy of establishing direct connection by radio telephone between adjacent dispatching centers which are co-operating regularly should, we believe, supersede the plan of relaying messages between important plants involved in the interchange. Time is required to accomplish this, but the value of interconnected service justifies thorough and modern arrangements.

Relieving Short Stocks

LET the importance of more efficient distribution of electrical goods not be lost sight of in the laudable pursuit of increased production. The times are ripe for thoroughgoing analyses of distribution costs and requirements in many branches of commerce and industry. Too much guesswork has impaired the accuracy of many utterances upon this subject in the past. By relieving short stocks as much good, if not more, can be accomplished as by increasing per capita outputs in the factory. Scientific analysis of the volume, character and localization of demands will help mightily in this direction.

Utility Profits and Development

A CALIFORNIA banker, in testifying before the commission of that State, expressed the opinion that it was more to the interest of the people to see that hydro-electric power was properly developed than to bicker over fractional differences in the number of cents to be paid for a kilowatt-hour of energy. In support of this opinion he instanced the great San Joaquin Valley, now only one-fifth developed and dependent absolutely upon hydro-electric power for the development of the other four-fifths. The power cannot be furnished without capital, and capital, other things being equal, goes where the highest price can be had. Are not those who would hold the electric companies down to a profit so meager as to put their securities in the class of shopworn goods among the persons—as persistently with us as are the poor and respectable only for their numbers and their ancient lineage—whom the old saying calls penny-wise and pound-foolish?

Franklin K. Lane

THE approaching retirement of Secretary of the Interior Lane from the Cabinet will leave that body the poorer by the loss of a far-seeing, clear-thinking and conservative mind of the engineering type. His administration of his office enhanced still further its importance, already great when he entered upon it seven years ago. By his faculty of clear and comprehensive statement, by pen and by word of mouth, in his official reports and on the public platform, he did much to increase among the American people a true realization of the tremendous national wealth that is theirs for the development. He leaves the government at a time when the demand for food, for fuel, for manufactures of all kinds, and for power to aid in their production, is greater than ever in our history. The Department of the Interior, which is vitally connected with throwing open under proper safeguards the storehouses of the nation, may come to rank in time of peace as one of the three or four greatest divisions of the government. It will be fortunate if it shall always have at its head a man of Mr. Lane's caliber. Were there no other reason for approving him, electrical engineers and executives would find warrant for high praise in his consistent stand for and vigorous advocacy of a water-power and his broad-minded insistence that this act should be fair alike to the investor and the public.

The Jobber a Stabilizer of Merchandising

THE necessity of the electrical retailer in the chain of electrical merchandising has been broadly acknowledged within the last few years. The central station cannot get along without the contractor-dealer; rather than compete with him, it has advanced to the stage where it is ready to assist him in his business, helping him to improve his methods and increase his sales. Of recent months there has been some feeling on the part of the electrical jobber that his position should be similarly justified. The Electrical Supply Jobbers' Association has rather widely advertised its attitude in the matter, and the position of the wholesale distributer has been discussed on many occasions. The position of the power company was well stated in the discussions which were brought out at a recent convention of the Northwest Electric Light and Power Association in Seattle. There a question was asked as to how large stocks should be carried by central stations still in the merchandising business, and it was very frankly stated that the power company should depend upon the jobber to maintain large stocks and should

reduce its own stocks to a minimum compatible with efficient service to the public.

There is no question of the importance of the wholesale distributer in the stabilizing of merchandising conditions. His ability to study the local market and to handle demands in large orders is of inestimable value to the manufacturer. The convenience to the retailer, who thus has a large stock to draw on without the necessity of maintaining a considerable surplus in his own business, as well as the interest and assistance of the highly paid organization maintained by the jobber, is too great to need further comment.

Electrical Smelting Furnaces

WE ARE publishing in abstract an important paper on electrical iron smelting recently read before the Swedish Iron Institute by F. Holmgren. Sweden is a peculiarly favorable ground for the introduction of electric smelting because it is rich in high-grade iron ore and in cheap water power. Coal is high, and therefore there is every incentive to smelt the ore electrically if this process is practicable, as has proved to be the case. Mr. Holmgren's paper deals with tests made at several of these primary smelting furnaces in which the results had been not altogether satisfactory with a view to finding out the sources of loss and planning improvement. Some extremely important factors obtruded themselves immediately the investigations was started. At the very beginning it was found that with the heavy currents employed the location of the instruments at the transformers was a bad one and that it was necessary really to get information about the electrical conditions in the furnace itself before the case could be properly analyzed. In one furnace investigated the energy losses in the leads between the transformers and electrodes were nearly 20 per cent of the entire capacity of the furnace.

It was soon found that the important electro-magnetic forces due to the huge three-phase currents in the furnace itself must be seriously reckoned with. The unbalancing possible in the furnace and the eddy currents developed in the adjacent iron structures both proved to be large disturbing factors in the operation of the furnace. It proved, moreover, that there was no proper common neutral point which could be relied upon, so that the action in the furnace was unbalanced. In the original arrangement tried each phase was connected to two opposite electrodes, and the unsatisfactory conditions found led to the connection of each phase to two adjacent electrodes, with the result of considerably reducing the losses in the conductors and an improvement of the power factor from 0.7 to an average of 0.91. A second furnace investigated led to similar conclusions and to a similar change in the connections. In this case that there were extraordinary differences in magnitude and direction between the currents at the transformer terminals and at the electrodes was at once apparent, and on determining the distribution losses in various parts of the conductors it turned out that half of the total loss of a little more than 600 kw. between the transformer and the furnace was due to work done on surrounding iron structures, and that more than 500 kw. was transformed between one set of conductors and another. It was estimated that rearrangement of the leads corresponding to that in the first furnace studied would cut the loss in two.

Considerable trouble in the operation of furnaces was also traced to the unbalanced electromagnetic conditions inside the furnace. Anything, in fact, which produces uneven energy supply through the electrodes gives uneven distribution of heat and unsatisfactory operation. Aggravated by improper mixing of the charge, the conditions may be much worse. The whole investigation shows not only the extremely irregular conditions that may be produced in the secondary circuit to and in the furnace but also the very considerable loss chargeable to this cause. The nearer one can come to investigating the actual working conditions inside the furnace, the more information may be obtained as to methods of improvement. It is interesting to note that the experience gained through the smelting practices in Sweden shows that frequency in itself is not a very important matter, good results being obtainable with any of the standard frequencies which are in use from 25 cycles up.

The whole situation disclosed by Mr. Holmgren's investigation is extremely instructive as showing the very unusual conditions which arise in dealing with unstable balancing of very large secondary currents in proximity to magnetic masses. To see big cables writhing under their mutual stresses or perhaps bars torn from their supports gives a new point of view, and one which the article under notice shows to be needed in the study of these big smelting furnaces.

Power Shortage on the Pacific Coast

RELIEF from the serious power shortage in California has in some measure been gained by transfers of power from one system to another by means of interconnections, but the ultimate accomplishment in this direction has about been reached. Steam plants are being forced to the utmost, with considerable waste of fuel as a result. Crude petroleum, which is the main fuel used in the steam-power plants of California, is steadily rising in cost. The conditions seem likely to have an important influence upon the electrical development of that State. It is apparent that in order to make provision for a series of very dry years there must be allowance for an increased "margin" between power-plant development and power-plant use. More hydro-electric plants will undoubtedly be constructed over a wide area, so as to take advantage of favorable precipitation conditions wherever they exist throughout the State.

Probably, too, considerably larger provision will be made for storage reservoirs; for, though in many quarters it is felt that storage of waters from year to year solely for power purposes is hardly feasible, nevertheless great reservoirs are to be created in the West to store water for combined power and irrigation uses, and these will tend to revive confidence in the ability of the power systems to tide over a future period of prolonged drought. The construction of additional auxiliary steam plants will be necessary to make the "working margin" of electric power in that State at all times certain.

Despite the rainless period and its attendant warnings to the industry, it must not be assumed that alarmist sentiments prevail in the councils of Pacific Coast power companies. They are going forward with their plans for immense development in the near future, knowing that the ever-increasing demand for electrical

energy for industrial and agricultural purposes will insure the stability of investments in hydro-electric power plants. Yet the prevalent drought serves as a reminder that adequate reserves to provide for emergency are equally necessary in the power industry as they are elsewhere.

High Tension Air-Break Switches

ELECTRICAL engineers on the Coast, which has been for years the skirmishing line of electrical progress, have developed the air-break switch for transmission lines to a point far beyond its earlier expectations. When one is working at from 60,000 to 150,000 volts the oil switch proposition, excellent as it is in its results, becomes a serious item of expense. Like many other elements of the switching equipment, it has grown from a piece of apparatus to an architectural magnitude, and particularly on rather lightly loaded lines the cost gets burdensome. Our readers will therefore be interested in an account of the air switches used by the Southern Sierras Power Company, at present operating the longest straightaway transmission line in the world, stretching for more than 400 miles (650 km.) from the source of power at Mono Lake to the Mexican border. There are cases of longer transmission under certain circumstances between stations on extensive networks, and through interconnections of power systems which do not fundamentally depend on extreme long-distance work. But the claim of the system here considered to be the longest transmission line at present in regular operation we believe to be substantiated.

Six months ago the main line, which had been working at 60,000 volts, was raised to 90,000 on the way to the limit of 140,000, which will be used later. At each of the main control points along the line air-break switches have been installed on the main circuit, built for 140,000 volts working pressure. At the remote points there is always about 350 miles (550 km.) of line to be dealt with, so that the conditions are extreme. For this formidable task switches were constructed having a vertical break which appears to give the most favorable condition for clearing the arc. The spacing between phases is no less than 14 ft. (4.3 m.) and the end horns flare somewhat across the line away from the center horn, giving an increased spacing and factor of safety at opening. They are of single-break construction, each mounted on a steel tower. In all nine such units have been installed. In spite of the extreme length of the switch blades they are easily operated, thanks to their lightness. Each blade is built up of a pair of tapering pressed-steel channels which are inter-braced and connected with copper ribbon conductors. Attachment of the incoming aluminum cables is made at the hinge ends of the flexible cables by a suitable lug. The horns are of galvanized steel tube, also tapered. The operation of these switches as time goes on will be watched with a good deal of interest, as they are quite the largest yet constructed, but there seems to be no reason why they should not operate successfully. The main difficulty to be feared is the slower break than with oil switches involving some risk of resonance phenomena. The general success of air-break switches before has led to confidence in undertaking their use under what will be, when the full voltage is reached, extreme conditions.

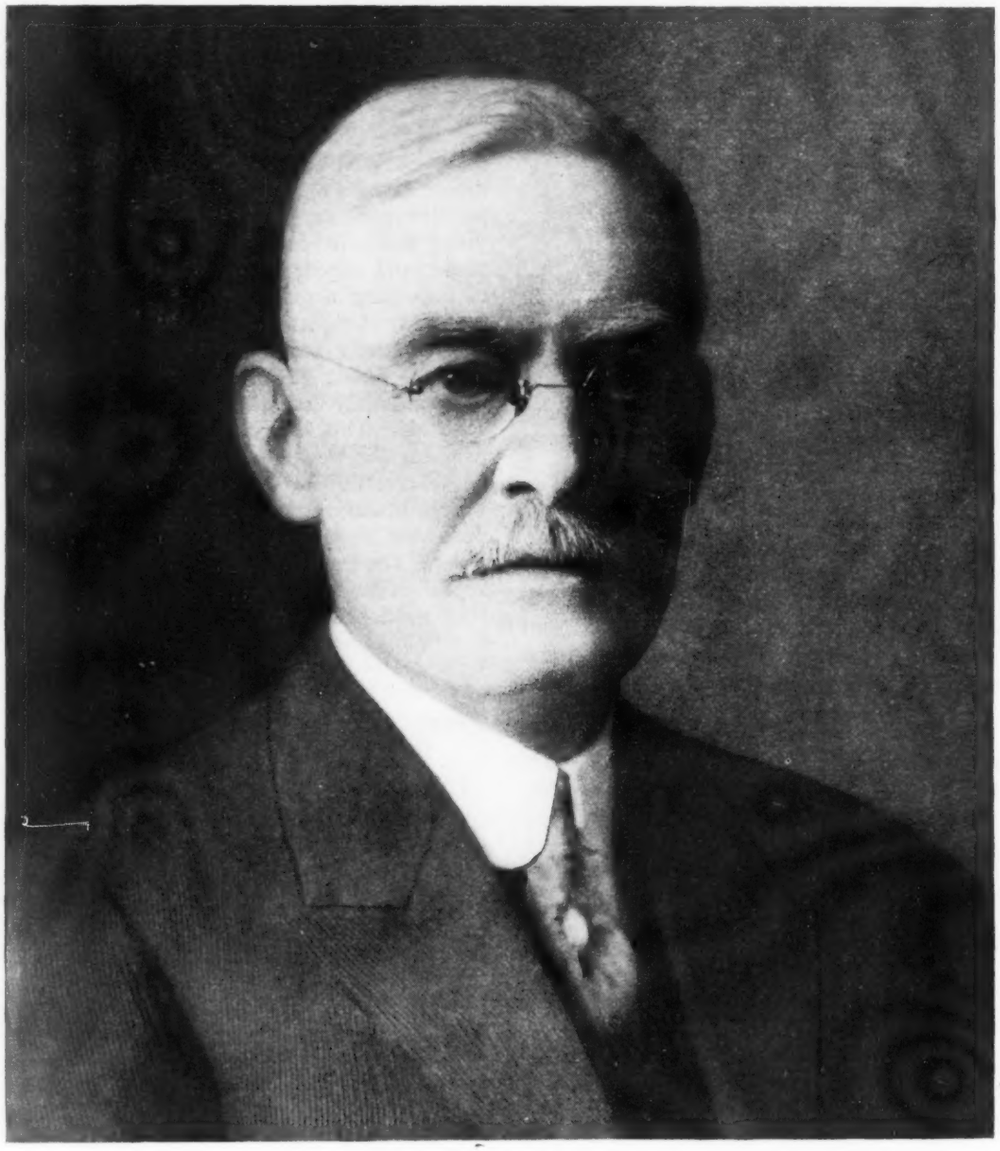
Piece Work on Motor Repairs

IN ANOTHER issue of the ELECTRICAL WORLD an account was given of some of the experience gained in one of the big Pennsylvania steel mills in making necessary motor repairs, particularly to armatures and commutators. This mill, as the last word suggests, has direct-current equipment, and it was found that the motor repairs made by day labor seemed to be unnecessarily expensive. It was therefore decided to introduce piece work in the repair shops, and consequently a piece work schedule was applied to all the various items of repairing armatures and commutators. The workmen at first objected, but on trial it was found that they were actually making high wages—for the armature winders about $1 an hour, on piece work based on approximately one-third of the daylight work-time schedule. This is a large showing for savings, without pressing the workmen in the matter of wages. It would be interesting to know the total amount of repairs, which would throw considerable light on the ultimate desirability of direct-current motors in this kind of work. The general principle, however, of piece work on repair tasks which have often to be repeated seems to be a good one and one worthy to be followed wherever the requirements justify it.

Trying Daylight Saving on a Partial Scale

THE French government has recently adopted a program of daylight saving for two years, the date of setting the clocks ahead being fixed as March 15. This is considerably earlier than any date contemplated here, but of course France as a whole lies fully 5 deg. further north than the northern United States, which perhaps accounts for the difference. For our own country in general the date heretofore set is more appropriate. Just what the spasmodic efforts made here in various cities to continue daylight saving will amount to remains to be seen, but where they are to be supported by local authorities it will be wise to settle on the same conventional date of change. We recently published a study of the effect of daylight saving on residence lighting, worked out from Boston data, which was very instructive. It showed an actual reduction in lighting bills amounting to only a little more than 3 per cent. This is considerably less than the estimates that were made when the first enthusiasm was high; it is so small in fact as to be quite lost in the shuffle of a central station's business.

So far as the lighting industry is concerned there is no particular reason for or against daylight saving except possibly in a very few localities. The matter is really wholly one of the convenience of the working public, and here it is virtually reduced to a question of city versus country. Unquestionably the average city dweller is a gainer while the farming communities stand to lose owing to the entirely different situation respecting hours and conditions of business. At present we seem to be in for a "double standard" of sunlight, and it will be extremely instructive to see how it works out after a year's experience. The thing most seriously affected is railway working, particularly with reference to suburban schedules, and here will come the real test of the double system as a matter of all-around convenience.



John A. Britton

A foremost builder of the West as engineering executive of the most extensive hydro-electric distribution system in the world

LONG before the hydro-electric plant on the San Antonio Creek, the first hydraulic station to be installed in California, was placed in operation, and sixteen years before the famous single-phase transmission line at Telluride was completed in 1890, John A. Britton became identified with central-station operation on the Pacific Coast. His forty-six years of active service have been part and parcel of the wonderful story of how water powers have been harnessed and high-tension lines built and interlaced in the Land of the Golden Sunset. It is a story built on courage, foresight and ability to estimate accurately the future possibilities of electric service. Mr. Britton became an employee of the Oakland (Cal.) Gas Light Company in 1874, steadily advancing to the position of president. Since 1907, as vice-president and general manager of the Pacific Gas & Electric Company, in which the earlier companies were merged, he has had charge of all construction work and been responsible for the operating and financial policies of the company. It is not only as an executive-engineer, however, that Mr. Britton has won distinction. His work on the public policy committee of the N. E. L. A. is well known; he has been for many years a member of the board of regents of the University of California and was a prominent director of the Panama-Pacific International Exposition.

The California electrical co-operative campaign and its beneficial results have largely been made possible through the foresight of Mr. Britton, who many years ago recognized the potential importance of the trade in the molding made possible through Mr. Britton's foresight.

Naturally he has been among the foremost and best equipped advocates of water-power development, and the fulfilling of his reasoned prophecy of what it would mean to his section emphasizes, when it is viewed in the light of his actual accomplishments, his right to the place he now holds as the foremost of the builders of the West.

Switching on the World's Longest Line

Method Employed by the Southern Sierras Power Company to Provide for 140,000-Volt Air-Break Switches on Each End of Its 348-Mile Transmission System

BISHOP CREEK STATION WHERE 140,000-VOLT SWITCHES ARE INSTALLED

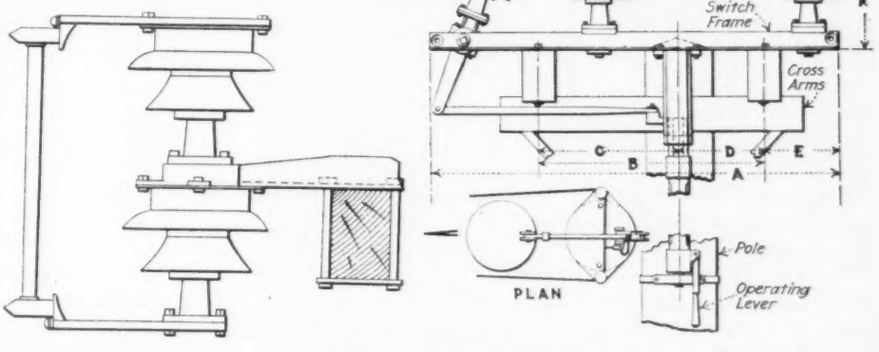
IN 1912, the Southern Sierras Power Company completed what was at that time the longest direct transmission system in the world, transmitting power from Bishop to San Bernardino, California, the length of transmission line being 238 miles (380 km.). The original voltage for operation was 60,000. The system was designed with the view to later raising the voltage to 140,000. Since that time the system has been extended from San Bernardino to the Mexican border, making an additional length of transmission of 110 miles (200 km.). In addition to this the main line was connected with what was the plant of the Pacific Power Company at that time, giving an additional length of 70 miles (112 km.). Thus the present distance of transmission from Bishop to the Mexican border is 348 miles (557 km.), the distance from Mono Lake to the Mexican border being 418 miles (669 km.), which is still the longest transmission in existence.

In July of this year the main transmission line, which has been operating at 60,000 volts, was raised to 90,000 volts, with the intention of later raising to 140,000 volts. As the sectionalizing switches along the line had been built for 60,000 volts, it was necessary, therefore, to replace them with switches designed for a higher voltage and rated at a higher capacity.

At each end of the original transmission, namely, at the Bishop control station and San Bernardino, air-break switches were installed in the main line, two switches being employed at each location.

Switching at 140,000 volts is not such an ordinary practice that it is viewed without misgivings yet, nor is interrupting a 348-mile (557-km.) circuit the simplest problem in the world. Still the Southern Sierras Power Company has tackled this problem in connection with the main transmission line from Bishop Creek station to the Mexican border, putting in outdoor air-break switches at the generating station and at San Bernardino. While the present operating pressure is only 90,000 volts the lines and switching equipment are being modified to withstand 140,000 volts, with the intention of raising to that pressure later.

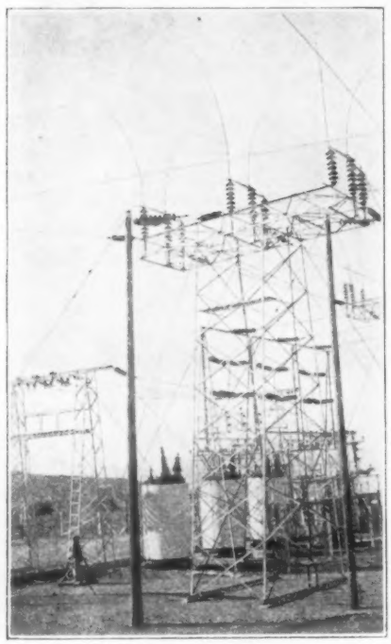
DETAILS OF 140,000-VOLT AIR-BREAK HORN-GAP SWITCH



In determining upon the most suitable switches for this work, the experience gained in several years of operation brought forth certain fundamental points of design, which were by all means desirable in a horn-break switch. The spacing between phases, which originally was considered safe, was found to be inadequate, and as

a result, the spacing has been materially increased. The reason for this was that with the closer spacing the arcs would blow across between phases and short the system. With the increased spacing this result is avoided. Increased spacing means, of course, an increased size of structure on which the switches are mounted. There are practical limitations to the increase of spacing, both in the cost of the supporting structure and in the available room, without changing the position of the lines.

There are on the market different types of horn-break switches, which may be classified in general in two ways:



HIGH-TENSION SWITCH TOWER

1. Those which break with a horizontal motion, the blade rotating about a vertical axis.

2. The switches which break in a vertical plane, the arc being drawn upward by the action of the blade.

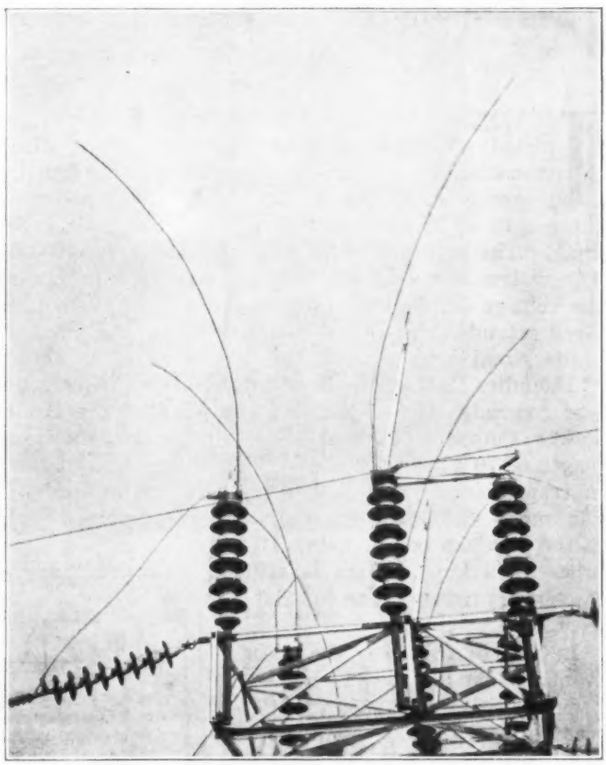
The switches which operate by rotation will of necessity call for relatively large spacing between phases, since the horizontal motion of the blade will draw the arc over in the direction of the adjacent phases. This is evidently a very undesirable result, not only on this account, but also because the arc starts at a point near the top of the insulators, where the wind is very liable to blow it either onto the insulators, with danger of cracking, or down to the framework. With a vertical break, on the other hand, the spacing between phases may be minimized. The arc is drawn upward by the contact on the end of the blade, and is, therefore, first established at a point a considerable distance above the top of the insulators, where it cannot touch the insulators or short on the framework.

The switches which have been adopted by the Southern Sierras Power Company for the intermediate stations on their transmission line are the largest air-break switches which have ever been built. The spacing between phases is 14 ft. (4.3 m.). The end horns in addition to flaring in the usual manner, flare across the line away from the center horn, thus providing an increased spacing where the arc grows longer, and giving an increased factor of safety. Eight of these switches are installed at the stations on the main transmission line and one switch at Plant No. 3, near Bishop. The switches are single vertical break, and each switch is mounted on a steel tower. The illustrations show the general nature of the construction. Each pole of the switch is supported on a single insulator, built up with six 14-in. (3.5-cm.) Ohio Brass disks. These insulators are of the sectional type, the various sections being interchangeable, so that in event of damage to any insulator it is necessary to replace only the damaged unit. As this work is accurately done in the factory, it is a very easy matter to make replacement should any be required.

Great care is used in the assembly of the insulators, the tops of insulators being coated with paraffine and gaskets being used throughout between pin and insulator and also between the cap and insulator. The latter are subsequently removed after the cement has hardened, in order to prevent any possible effect of endwise temperature strains cracking the shell of the insulator. The insulator pins and caps are made of malleable galvanized iron, accurately faced and drilled.

The sections of the insulator are bolted together by six ½-in. (1.3 cm.) bolts. An important feature in the design used is that the flanges are so located that they preserve the proper arcing distance to ground. In some types of constructon this point is not carefully covered, in fact in some cases fully 40 per cent of the air gap to ground is sacrificed in the improper location of the flanges.

Owing to the necessary length of the insulators and the horns mounted thereon, it is essential that the whole



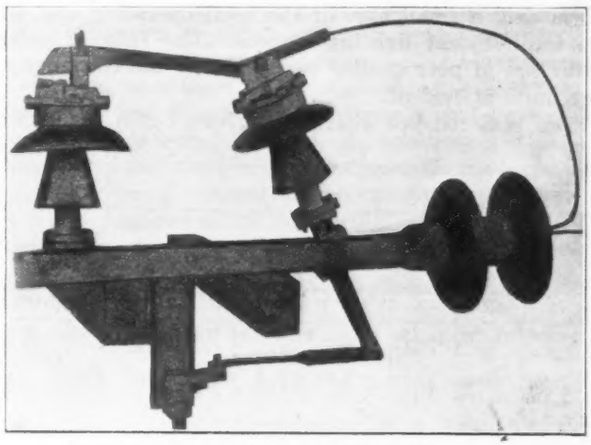
CLOSE-UP VIEW OF HIGH-TENSION SWITCH

structure, as well as the insulators themselves, be thoroughly rigid. This point is carefully covered in the design; at the same time the advisable factor of safety is in no case exceeded.

One important advantage of the separable type unit is not only its interchangeability, but also the allowance for changes in plant should any be necessary in the future. For instance, if it is desired to increase the insulation, additional sections of insulator may be added, or if it is desired to build up new apparatus, the same insulators may be used therefor. Another im-

portant feature of the separable type of unit is that all operating parts of the switch may be mounted independent of the insulators or the parts which mount thereon.

In spite of the weight of the operating insulators, the mechanism is so arranged that the operation of the switches is exceptionally easy. The mechanism provides a double toggle action when the blade is entering or leaving the clip, and a single toggle action at the other end of the stroke. The main operating shaft turns through 180 deg. for the stroke. This connects at the



HIGH-TENSION SWITCH CLOSED

upper end through a connecting rod, with a crank on the center insulator pin. The other insulator pins are operated through a longitudinal connecting rod. The hinge insulator pin carries an extended bearing, in which the upper end of the operating insulator rotates, thus making the main operating strain self-contained. On the upper end of the shaft extension of the operating insulators is mounted a crank, which operates the blades through a connecting link, this crank being nearly on dead center when the blade is in the clip. This, of course, greatly cuts down the torsional strains on the operating insulators, as well as the power to operate the switch. All connecting rods and links are adjustable in length, being provided with bronze ends.

The construction of the blades is interesting and novel. Owing to the length of the blades it is essential to cut down, as far as possible, the weight of the operating parts, to minimize the strains of operation and to prevent undue jar on the insulators. The blades are exceedingly light, and at the same time are strong and rigid. They are constructed with two special pressed steel channels, tapering in section in both directions toward the clip end. These channels are suitably braced at intermediate points, and two strips of ribbon copper are used as conductors. Current is taken at the hinge end through flexible cable into suitable lug, onto which the incoming aluminum cables are, in turn, clamped.

The clips are universal in action, each jaw consisting of a rigid face of cast brass mounted on a brass pin supported in turn on the spring, which is made of galvanized steel. When the switch is open the jaws come together, thus precluding the entrance of dirt. The usual type of clip employed leaves a small opening between the jaws when the blade is in open position, inviting a deposit of dirt on the contact surfaces with consequent heating and destruction of the clip, or in cold climates will allow the formation of ice between the clip faces, thus rendering the switch inoperative without suitable shelter hoods. With the jaws of the clip in contact when the blade is open this difficulty is entirely overcome. The accurate alignment is always available, whatever the position of the blades in the clips, owing to the universal joint. Flexible ribbon conducts the current from the clips to the base bar.

The horns are constructed of galvanized tubular steel, tapering in section from the lower end, thus providing a light and rigid construction without undue strain on the insulators. The magnetic material of the horns is expected to assist in extinguishing the arc.

The blades are equipped with follower contacts, with a flexible spring, which makes contact with a wiper finger against an auxiliary horn mounted on the clip cap.

A New Type of Hydraulic Turbine Runner

A NEW type of hydraulic turbine runner with the blades radially constructed for straight axial flow has been described by Forrest Nagler of the Allis-Chalmers Company. On account of its greater speed and lower cost, he predicts great usefulness for it in the field of low-head developments. The radial construction seen in the illustration is said to offer the absolute minimum of wetted surface and of bending moment on the roof of the blade.

The primary advantages are pointed out by the writer as follows: (a) Lower generator cost due to an increased speed of 50 per cent and over above previous practice. This saving varies from 15 to 35 per cent of the generator cost, depending on its size and speed. (b) Lower turbine cost due to simpler runner. This averages around 10 per cent, the runner being about one-third the weight of the corresponding mixed-flow type and much easier to build either solid or with separate blades. (c) Smaller generator diameter,

HYDRAULIC RUNNER FOR STRAIGHT AXIAL FLOW

which in turn means a smaller power house. (d) Higher generator efficiency, due to better design possible with the higher speed. This is seldom less than 2 per cent gain and may conservatively be stated to vary from 1½ to 3 per cent. (e) Greater turbine flexibility, which permits the plant to give more power under flood conditions when the head is greatly reduced. More complete information may be obtained by reference to the *Journal A. S. M. E.*, December, 1919.

Analysis of Incandescent Lighting Costs for a Year

Unit Operating Costs and Fixed Charges for All Sizes of Vacuum and Gas-Filled Lamps for Economy Comparison

IN DETERMINING the total operating cost of any system of lighting three items must be considered:

First—Fixed charges, which include interest on the investment, depreciation of permanent parts and other expenses which are independent of the number of hours of use. Sometimes this item forms the greater part of the total operating expense, yet it is only too often omitted from cost tables.

Second—Maintenance charges, which include renewal of parts, repairs, cleaning, labor, and all costs, except all units once each month. For the smaller units with steel reflectors the cost of cleaning is taken as $0.045 per unit for each cleaning. Data obtained from installations where accurate cost records are kept show that this figure is conservative for labor at $0.45 per hour. The cost of cleaning other reflectors is taken in proportion to the amount of labor required. Some illuminants require attendance at regular intervals. The cleaning is done at the same time and is, therefore, included under the maintenance charge. For units which require no regular attendance the cleaning expense becomes a separate charge. It will be noted that the fixed charges form only a small part of the total operating cost for an incandescent lighting system. The folly of using reflectors of poor quality which impair the efficiency of the units is evident.

The maintenance charge is given for a 1000-hour

ANALYSIS OF OPERATING COSTS—110-VOLT TO 125-VOLT INCANDESCENT LAMP UNITS*

Lamp and Reflector Data Upon Which Costs are Calculated

Size of Lamp, Rated Watts	Vacuum Tungsten				Gas-Filled								
	25	40	50	60	75	100	150	200	300	400	500	750	1000
Cost of lamp, list*	$0.350	$0.350	$0.350	$0.400	$0.700	$1.100	$1.650	$2.200	$3.250	$4.300	$4.700	$6.500	$7.500
Cost of lamp, standard package discount	.315	.315	.315	.360	.630	.990	1.485	1.980	2.925	3.870	4.230	5.850	6.750
Average cost of reflector with socket, standard package discount	1.700	1.700	1.700	1.700	2.200	2.300	2.300	3.200	3.800	3.800	3.800	4.900	4.900
Cost of unit, standard package discount	2.015	2.015	2.015	2.060	2.830	3.290	3.785	5.180	6.725	7.670	8.030	10.750	11.650
Operating Costs													
Annual fixed charges:													
Interest on total investment, 6 per cent	$0.121	$0.121	$0.121	$0.124	$0.170	$0.197	$0.227	$0.311	$0.404	$0.460	$0.482	$0.645	$0.699
Depreciation on reflector, 12½ per cent	.213	.213	.213	.213	.275	.288	.288	.400	.475	.475	.475	.613	.613
Labor, monthly cleaning	.540	.540	.540	.540	.540	.540	.540	.810	.810	1.080	1.080	1.080	1.080
Total	$0.874	$0.874	$0.874	$0.877	$0.985	$1.025	$1.055	$1.521	$1.689	$2.015	$2.037	$2.338	$2.392
Maintenance, cost per 1,000 hours:													
Lamp renewals, standard package discount	$0.315	$0.315	$0.315	$0.360	$0.630	$0.990	$1.485	$1.980	$2.925	$3.870	$4.230	$5.850	$6.750
Lamp renewals, $150 contract discount	.291	.291	.291	.332	.581	.913	1.370	1.826	2.698	3.569	3.901	5.395	6.225
Lamp renewals, $1,200 contract discount	2.56	.256	.256	.292	.511	.803	1.205	1.606	2.373	3.139	3.431	4.745	5.475
Energy cost per 1,000 hours at 1 cent per kw.-hr.	$0.250	$0.400	$0.500	$0.600	$0.750	$1.000	$1.500	$2.000	$3.000	$4.000	$5.000	$7.500	$10.000

* The prices on lamps and reflectors upon which calculations of this table are based are subject to change without notice; they are used here solely for convenience in engineering calculations.

† Discounts range from 10 per cent. to 40 per cent, depending upon the quantity of lamps ordered.

the cost of energy, which depend upon the hours of burning.

Third—The cost of energy, which depends upon the hours of burning and the rate for electrical energy.

The life of a lighting system depends not only upon the wearing out of parts but also upon obsolescence. There are few installations in this country which have been in use for a period of seven or eight years which are not already obsolete. Although the lamps may be in good operating condition, economy demands that they be replaced by more efficient illuminants. The rate of depreciation on all permanent parts is equal to at least 12½ per cent. A table which would show the total operating expense of vacuum lamps for all sizes, with every discount from the list prices, for all possible periods of burning per year, and under all costs of power, would be so large that it would be impracticable to use it. From the table shown herewith, however, the operating expense of units under any set of conditions may be found with little calculation.

The total investment includes the cost of lamps, reflectors, holders and sockets. The investment in permanent parts is the total investment minus the price of lamps. No depreciation is charged against the lamps inasmuch as they are regularly renewed. The labor item under fixed charges provides for the cleaning of period of burning. To find the annual charge in any case it is necessary to multiply by the ratio of the total hours of burning to 1,000 hours. Where lamps are purchased at other than the prices given the proper correction should be applied. In an incandescent lamp system the renewal of lamps is practically the only maintenance expense.

The energy cost is given for a 1,000-hour period with energy at $0.01 per kilowatt-hour. The energy cost per year is found by multiplying by the cost per kilowatt-hour in cents and by the time of burning in thousands of hours.

An example will illustrate the use of the table. It is required to find the total operating expense per unit per year for lighting an erecting room in showing the procedure in illumination calculations. This room was lighted with 1,000-watt gas-filled lamps. The lamps are burned a total of 4,000 hours and are purchased at the discount obtained on a twelve-hundred-dollar contract. The cost of energy is $0.02 per kilowatt-hour.

From the table we obtain the following:

(1) Fixed charges	$2.39
(2) Maintenance, 4,000 × $5.475	21.90
(3) Energy, 4.000 × 2 × 10.00	80.00
Total	$104.29

The table was taken from Bulletin 20A by Ward Harrison and H. H. Magdsick, National Lamp Works, Cleveland, Ohio.

Problems in Electric Furnace Smelting—II*

Furnace Losses Are Greatly Decreased by Rearranging Transformer Leads—Irregularities in Operation Between Electrodes of Shaft Furnace Are Discussed and Remedies Pointed Out

By F. H. HOLMGREN

RADICAL reduction in losses and improvement in power factor of polyphase electric smelting furnaces of the shaft type were brought about by carrying transformer terminals to adjacent electrodes instead of to opposite electrodes. The tests were fully described in the ELECTRICAL WORLD for Jan. 24. The measurements give a clear picture of the electrical conditions up to the electrodes and show the best method in which to arrange the leads. Inside the furnace the resistance can be divided into a "working resistance" in which the principal energy is developed and a "conductor resistance" between the electrodes. It has been shown how the currents pass through this conductor resistance, but it has not as yet been possible to determine the relative magnitude of the two resistances, which undoubtedly has an intimate relation to the operation and the furnace temperature.

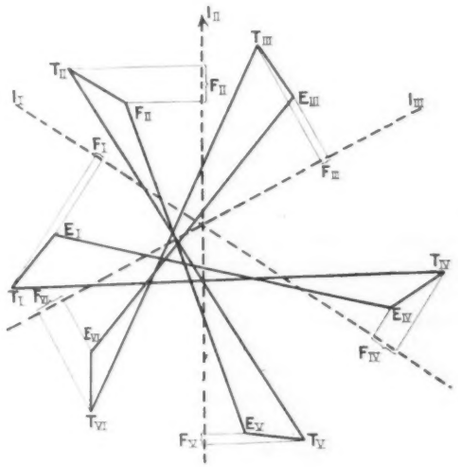


FIG. 8—DIAGRAM OF TEST OF FURNACE NO. 2 AT DOMNARFVET

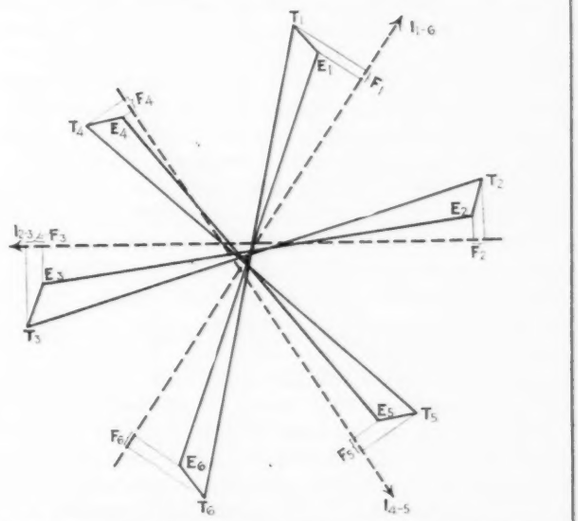


FIG. 9—VOLTAGE DIAGRAM FOR FURNACE WITH CORRECT ARRANGEMENT OF LEADS

It can safely be assumed that unequal heat supply also was the cause of the irregular operation which was noticed both in furnace No. 4 at Domnarfvet and in the Soderfors furnace before the connections were changed, while the performance of furnace No. 2 at Domnarfvet was decidedly better from the beginning. As seen from Fig. 8, the leads did not here cause the same disturbing effect on the instrument readings. Regardless of how the furnace leads are arranged, the instruments must always be connected as close to the electrodes as the heat radiation from the furnace will permit. With a perfect arrangement of the leads, this is of course not so important, as confirmed by Fig. 9, which represents a voltage diagram of the Soderfors furnace after the leads had been changed. This diagram should therefore be compared with diagrams Figs. 1 and 3, but above all with Fig. 6.

From the preceding there is good reason to believe that there exists a certain reciprocal action between the electrical and metallurgical phenomena inside the furnace which it is of utmost importance to understand.

Earlier investigators have already dealt with the equilibrium of electric furnace operation in that with a surplus of coal the operation will readily become "hot," meaning that the furnace temperature would be above normal, while with a surplus of ore it will become "cold," meaning that the furnace temperature would be below normal. The former condition is characterized by a tendency of the current to rise, that is, the resistance in the furnace drops and the temperature rises with reduced operation. Referring to the previously mentioned division of the resistance inside the furnace, we find in the first place that the "working resistance" drops, which undoubtedly depends on the reduced operation.

It may be possible that this takes place because in the active arc zone the reduced iron drops down into the bath below the electrodes and the carbon monoxide escapes by the easiest way along the electrodes up to the stack, whereby the section nearest these will be exposed to an unusually severe heat.

The gas blast will cool the mass and the arch between the electrodes, whereby at least the upper part of the mass between the electrodes will have a relatively low temperature and a correspondingly higher resistance.

If now there is a reduction in the operation on account of a surplus of carbon, then the real smelting

*Abstracted and translated from the transactions of the Swedish Iron Institute by E. A. Lof.

zone, which therefore practically contains iron drops and rising carbon monoxide, will be thinner and thinner and the working resistance will drop. The surrounding zone, which practically consists of conducting carbon, will be forced more and more toward the electrode, until it finally sticks to it and the "working resistance" ceases more or less to exist. The resistance between the electrode and the mass is thus exceedingly small and the current rises considerably. As the reaction $FeO + C = Fe + CO$ is strongly endothermic, and as any cold charge is prevented from descending into the bath, the reduced operation will always mean an increased heat supply to the mass surrounding the electrode, which also in turn lowers the resistance in the mass between the electrodes. If there is in the charge when it enters the hearth a certain surplus of carbon in proportion to the available oxygen for formation of CO, then there is, of course, no possibility for this to oxidize, as, contrary to the case with ordinary blast furnaces, the mass is not passed through by any gas with an oxygen surplus. An accumulation of carbon will then take place which will more and more prevent the charge from descending, and a reduced operation will result. Such carbon accumulations are especially apt to take place when coke is used on account of its compact nature and its tendency to graphitize.

The "cold" operation, on the other hand, is characterized by the fact that with a rich, easy reducible ore there will be a too large arc zone around the electrode with accompanying high "working resistance." On account of the increased operating condition, the surrounding mass will not be sufficiently supplied with heat, but will solidify. The arcs between the electrode and the mass will finally go out and the operation will stop.

Unbalanced Operation Between Electrodes

As has been pointed out above, the heat supply has often proved to be very irregular at the different electrodes. On the other hand, it seems to be true that the arc zone, which is desirable for a successful and regular operation of the furnace, has a certain relation to the operating conditions of the electrode in question. As soon as the charge around the electrode reaches an unsuitable composition (surplus of coal or ore) it has been found that the operating conditions become bad, owing either to electrical heat supply with accompanying disturbance of the electrical phenomena (during "hot" operation) or because the electrical phenomena have been disturbed with an accompanying checking of the electrical heat supply (during "cold" operation). In the former case an increased ore supply is resorted to and in the latter a reduced supply.

That the heat in electric furnaces is very unevenly distributed cannot be disputed, and that an uneven energy supply through the electrodes will still further increase this condition is self-evident. The result of this has also often showed itself during tappings in that the iron then often shows a changing temperature. It even sometimes happens that at tappings iron and slag will be poured in alternating successions.

It shows therefore that there has been an irregular metallurgical condition at the different electrodes, depending partly on the uneven energy supply and partly on a different composition of the charge at the different electrodes. At one electrode the furnace may thus show typically "hot" operation with a low effect, while the operation at the other electrodes may be entirely normal. The uneven successive tapping of iron and slag can naturally also be due to the fact that under each electrode there has been formed an individual iron bath with accompanying slag cover, which confirms the unequal heat distribution within the furnace.

Electrodes Should Be Controlled Individually

It seems therefore as if the crucible of an electric furnace can be considered as consisting of a number of furnaces equal to the number of electrodes. When the operation of an electrode tends to get "hot" it should therefore be possible to prevent this by cutting off the current from this electrode for such a length of time that the surplus of carbon may be removed in some manner. As an increased ore supply through the stack affects all the electrodes, it would seem that in order to obtain a steady operation of the furnace the electrodes should be controlled individually. With "hot" operation ore should therefore be supplied through special holes in the dome to the respective electrodes if such holes will not unduly weaken the furnace construction.

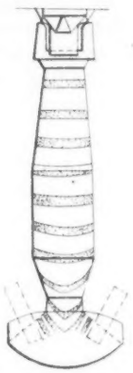


FIG. 10—PROGRESS OF CHARGE THROUGH FURNACE

The uneven distribution of coal and ore in the charge, which is liable to cause a "hot" operation, should therefore be avoided by a careful mixing before the charging. If ore and coal are supplied to the furnace in the ordinary way in the form of alternate layers, it is possible that the profile of the stack may influence the charge at the electrodes. If we follow the layers down through the stack, we find that the sinking will be more rapid in the center of the stack on account of the friction against the walls (Fig. 10) It is therefore possible that the occasional surplus of coal is due to the fact that a layer of coal, or a part thereof, during its progress through the bosh will take up a position parallel to the electrodes and finally surround the same in the form of a mantle and thus prevent the operation with a resulting overheating.

Another kind of "hot" run is also possible, namely when the electrode is unable to burn itself free and form an arc, regardless of the fact that the charge does not contain any local or general surplus of carbon. This may depend on the special nature of the electric furnace process, in that the furnace can only be supplied with a sufficient quantity of electrical energy required by the process on the supposition that this is produced in arcs. By simply conducting the circuit through the charge it is not possible to produce the required energy and heat for the furnace, on account of the limited low value of the resistances. Why a reaction corresponding to this energy does not take place in the mass so heated, and thus cause reduced operation, is difficult to explain. Instead we obtain a surplus of heat in the furnace. It may possibly be caused by the fact that the smelting process ceases and that therefore the reduced material is not removed as rapidly as necessary.

Causes of Operation With "Frozen" Electrodes

This corresponds to what was found with the Helfenstein furnace. A low electrode voltage could not be used on account of the inside resistance of the furnace. The operating capacity was very small and the operation very "hot," the heat rising further and further in the

bosh and stack. As soon as a higher voltage could occasionally be noticed at any of the electrodes an increased capacity was also observed. The electrode had then very likely burned itself free, while the Helfenstein furnace thus "normally" ran with frozen electrodes. The reason for this might have been that the contact surface between the electrode and the mass, due to the furnace construction, was too great, so that the energy required for burning the electrode free was greater than could be produced with the arrangements of the leads, etc.

"Hot" operation due to the same cause was also noticed in the Soderfors furnace before its reconstruction. The great distance to the bottom of the furnace made it often necessary, especially with hangings, to push the electrode far down in order to get any current to pass. When then the charge fell the reaction surface became too great and the electrode was unable to burn itself free. On account of the great free length of the electrodes within the crucible and their slope with respect to the "falling-down" angle of the mass, they were often broken. The remaining stump was then quickly pushed down to prevent burning of the roof, and contact with the broken-off part was established, with the result that the reaction surface became still greater and a burning-free was impossible. Since the height of the crucible has been considerably reduced, any "hot" runs from this cause have not been observed.

Reducing Losses by Rebuilding the Crucible

As a result of the rebuilding of the crucible it may be noted that with a suitable electrode surface in the mass the current became relatively low, which, of course, was of greatest importance as far as the secondary transformer windings and the low-tension leads were concerned. It was furthermore possible to keep the voltage high without unduly overheating and damage to the furnace lining. The low current had an especially favorable effect on the losses in the conductors, as these were reduced to only about 180 kw. from 282.5. The inside resistance of the furnace was increased from 1,250 microhns per electrode to not less than 2,700 microhns, and it is, of course, desirable to keep this resistance as high as possible. The upper limitation is the risk of "cold" operation with a rich charge and irregular operation on the whole, this being due to the tendency of the arcs to go out and also to the silica reduction.

From the above it is apparent that it is very important to use electrical measuring instruments for obtaining a knowledge of the metallurgical progress inside the furnace. The operation is closely related to the load for the same charge, and it is necessary to gain a knowledge of the resistance which is obtained in the furnace for different compositions of the charge in order to determine on the best operating method therefor. With a charge rich in ore, and thus with low resistance, for example, it is not permissible to wait with the lowering of the electrode until the same voltage is reached as is reached with a poorer charge and a relatively high resistance.

Considerations in Planning New Electric Furnaces

Frequency.—Some of the furnaces with the original arrangement of the connections—that is, with the transformers connected to opposite electrodes—operate with 25-cycle power and a good power factor. There are also several furnaces with the new arrangement of connecting the transformer to adjacent electrodes in operation on 50-cycle power, with good power-factor results and low losses in the conductors. If the leads, therefore, are correctly arranged, it may be stated that electric furnaces can be satisfactorily operated with any of the standard frequencies now in use.

Electrodes.—There are two ways in which the capacity and thus the production of a furnace may be increased. One is by increasing the electrode diameter with the number of electrodes remaining the same, and the other is by increasing the number of electrodes, keeping the diameter the same. Both these arrangements necessitate an increase of the current supply. An increase of the voltage is, however, not permissible on account of the irregular operations which would result therefrom and the effect which the voltage has on the furnace process in reducing the silica. Of the two first named arrangements, an increase in the size of the electrode will surely result in an increased operation on account of the larger smelting zone which is thus obtained; but the difficulties with the current supply will also grow in that the "useful" area of the electrodes, due to the skin effect, will not increase in the same proportion to the actual area. Besides this, there will be increased difficulties in connection with the leads for carrying the large currents. It seems therefore as if more can be gained by the second alternative; that is, by increasing the number of the electrodes. At present there are furnaces in operation with four, six and eight electrodes, and from the electrical point of view there is no reason why the number cannot be increased to nine. The "neutral" column of the charge is, however, likely to be larger and larger, and it may be questioned whether it would not be advisable from an operating standpoint to raise the bottom of the crucible in the center when the diameter has reached a certain dimension, provided that this would not cause an increased pressure of the charge against the electrodes.

Electrode Terminals.—This is generally one of the weak points in electric furnace installations, and every effort should be made to improve the same. A good contact is essential, as about 30 to 40 per cent of the losses from the transformers to the electrodes are to be found here. Arrangements should also be made to facilitate a quick change of electrodes and an easy raising or lowering.

Leads.—As has already been explained, the tests and investigations have shown conclusively that the leads must be arranged in a manner which will reduce the resultant electromagnetic fields to a minimum. Conductors which carry the same current but in opposite direction should be placed together as closely as possible. This led to the suggestion of connecting adjacent electrodes to the same transformer phase, whereby a much better power factor is obtained and also shorter connections and lower losses therein. The form of the conductors is also of great importance with alternating currents when large currents have to be handled, on account of the influence which the electromagnetic field around the conductor has on the current distribution within the conductor, reducing the useful area. It has also been proved that with uncompensated conductors very little is gained regarding the current distribution therein, whether these consist of multiple or solid bars. Better radiation is, of course, obtained, and therefore a lower direct-current resistance; but the current within the conductors will nevertheless be distributed as if the

conductor had been solid. Where the conductor run is uncompensated—that is, where it is impossible to interleave + and — bars—it is advisable to arrange the conductor in the form of a pipe [O], two half pipes [( )] or even as four bars arranged to form a square [□]. At 50 cycles it will be possible in this manner to bring down the losses to less than one-half of that with parallel bars. In other words, only one-half the amount of copper need be used in these portions of the leads.

As far as the compensated part of the leads is concerned, much has been done to reduce the surrounding electromagnetic fields by interleaving the + and — bars. For the same area the resistance will also be lower if the thickness of the two outside bars is only made one-half of the inside ones. Where the individual bars are of different lengths the longest ones should be placed outside so as to obtain as low a field as possible around the same. Each bar should preferably be connected to an individual transformer winding, and in such a case the forward and the return conductors should be bunched and interleaved. They should also be arranged so that the voltage drop in the conductors to the individual transformer windings will be as nearly alike as possible, in order to assure an equal distribution of the load among the different windings. When pipes are used for the leads the amount of copper can be reduced by water cooling. The losses will, however, be higher. Such water-cooled pipe conductors are often used in the leads nearest the electrodes where the heat from the furnace is excessive.

Electrical Arrangement.—From what has been said in the above it is evident that the shorter the leads the better will the operation be from the electrical point of view. This was fully demonstrated in furnace No. 2 at Domnarfvet, where the transformers were placed immediately adjacent to the furnace and where the operation was the best from the beginning. From the general operating standpoint, however, this arrangement has many disadvantages, in that it takes away much of the space nearest the furnace which is essential for the operation otherwise. Besides this, the transformers are directly exposed to the heat from the furnace. This arrangement has therefore not been followed in the later installations, where the transformers have been placed in a common room separated from the rest of the installation. This transformer room has in different installations been installed at different elevations with respect to the control platform, but the leads have generally been carried along the ceiling above this platform and from there down to the electrodes. It would seem advisable, however, to install the transformers at such a height that their terminals would be at the same elevation as the electrode terminals. In other words, the leads should, if possible, be installed in a single horizontal plane.

Furnace Operation from the Electrical Point of View.—In the preceding paragraphs it has often been pointed out that in the electric furnace process the metallurgical and electrical phenomena have an intimate relation to one another, and from this it follows that the operation must be conducted with this in view.

The problem is to produce the greatest quantity which the limitations of the installation will permit, and this with due consideration of the quality of the product. When such a furnace can produce up to 10,000 tons of pig iron per year, and possibly more, the importance of keeping the operation uniform and as near maximum as possible is obvious. All interruptions, etc., should be localized to include as small a part of the installation as possible.

On account of the connection to the transformers, there has so far always been a mutual electrical relation between two electrodes. But, inasmuch as the operation has been found to be somewhat independent at the different electrodes, the question arises whether it would not be advisable to make an arrangement whereby each electrode could really be independent of the other. This could most easily be done by means of a bottom electrode connected to the transformer neutral. Whether this would meet with any practical difficulties, however, must first be investigated. Another advantage of this would be that in case of repairs or when changing electrodes only one electrode need be disconnected. With a surplus of coal at one electrode the current could temporarily be shut off from this electrode to prevent "hot" operation. A closer and more frequent regulation of the electrodes would then also be possible, thus permitting the highest voltage to be maintained more uniformly.

The electrical instruments serve as a good guide to the operator, provided that they are connected so that the leads to the furnace have no disturbing influence. Individual measurements at the different electrodes are preferable, and, for this reason, the instruments should be connected either to the bottom electrode, if there is such a one, or otherwise to some suitable conducting point in the bottom of the furnace. Besides a voltmeter which it should be possible to connect between the neutral and the respective electrodes, there should always be a wattmeter for each pair of electrodes, the potential coil of which can be interchanged to different electrodes. By thus carefully following the electrical progress at each electrode, especially as regards the size of the "working resistance," it would at least be possible to discover in time when there is a tendency for "hot" or "cold" operation and thus to take the necessary precautions against it. A knowledge of the load on each individual electrode should also give an indication of the limitations as far as the furnace lining is concerned, and it would be highly desirable to have pyrometers installed in the roof near the electrodes if this could be done from a practical point of view. It would then be easy to determine when the electrode should be lowered.

CONCLUSION

1. The low-voltage leads are of utmost importance as far as the losses and power factor are concerned, and their arrangement should be carefully planned in new installations.

2. The electrical measuring instruments should be arranged so that they will really indicate the electrical conditions at the electrodes.

3. There is an intimate connection between the electrical and metallurgical phenomena at the different electrodes, and an individual control of the electrodes is desirable. It seems that the electrical measurements should be a good guide in determining the metallurgical progress, and for this reason we should endeavor to obtain a deeper knowledge of the relation between the electrical measurements and the metallurgical phenomena. An intimate collaboration between the metallurgist and the electrical engineer is essential in this study, as it is in the study of the physical character of the arc zone.

Checking Differential Relay Installations

Method of Avoiding Incorrect Connections, a Current Transformer with Improper Ratio, or Relay with Wrong Number of Turns, Etc., That May Cause Tripping Flux in Relay Under Normal Conditions

By RAYMOND BAILEY
Philadelphia Electric Company

MUCH time and thought is usually devoted to the selection of the relays by large power generating and transmitting systems for the purpose of automatically disconnecting defective equipment, but the most careful selection is without avail unless tests are made to insure that the relays will function as desired. A very small error in the installation may cause the relays to disconnect the part of the system to which they are connected in time of trouble on some other part of the system, thereby defeating the very purpose for which the relays are installed.

A method for checking double-winding* differential relay installations, extensively used for the protection of power transformer banks, is outlined in the following paragraphs. Figs. 1 and 2 show the connections of this type of relay applied to three-phase/three-phase and three-phase/two-phase transformations respectively.

An incorrect connection, a current transformer of improper ratio, or a relay with the wrong number of turns, etc., may produce a resultant flux in the relay core when the transformer bank is carrying normal load current. Even though this resultant flux is not great enough to operate the relay under normal load conditions, it may cause the relay to function in case of a short circuit somewhere on the system supplied by the transformer bank, which would, of course, be very undesirable.

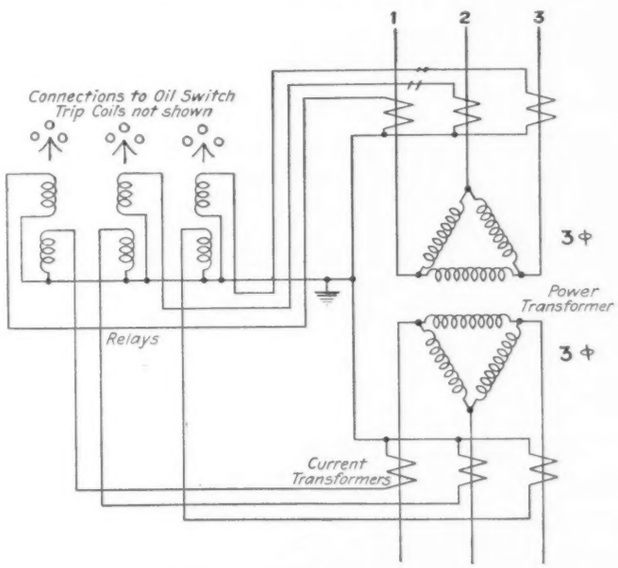


FIG. 1—CONNECTIONS OF DOUBLE-WINDING DIFFERENTIAL RELAYS TO A DELTA-DELTA POWER TRANSFORMER BANK

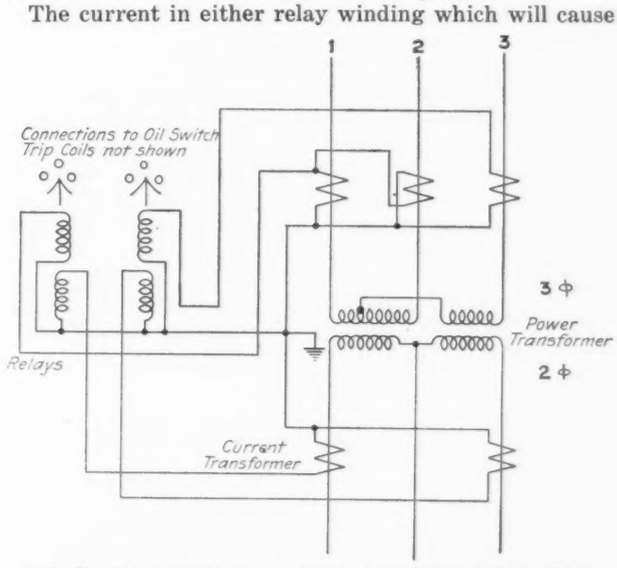


FIG. 2—CONNECTIONS OF DOUBLE-WINDING DIFFERENTIAL RELAYS TO A T-CONNECTED POWER TRANSFORMER BANK

The test outlined in this article requires the use of a special test core, which is substituted for the relay core during the test, and a low-reading voltmeter. The test core is in reality the secondary of a transformer, the primary of which consists of the two relay coils differentially connected, and is used to determine the magnitude of the resultant flux. It is not intended to include in this article the design data for the test core in view of the fact that it would apply only to the type of relay for which it was built. Fig. 3 will, however, give the reader a general idea of the construction of the core, which has about seven hundred turns of No. 31 magnet wire on it.

The best results will be obtained from tests with this core if it is kept in mind when designing the core and making the tests that all resultant flux should link with the turns on it.

Before checking any relay installation a number of readings should be taken in the laboratory with the core and a relay for comparative purposes.

The current in either relay winding which will cause the relay to operate should first be determined. The relay core should be removed (this can usually be done by removing the thumb nuts on the lower end of the calibration tube) and the test core inserted in its place. Volts generated in the test-core winding by different currents (in one winding of the relay) up to and including the operating current should be read. The voltmeter used for this work should read as low as 0.5 volt and should require a very small current as the test core has a limited capacity.

*The ratios of turns of the relays and the current transformers are so arranged that the normal load current in the power transformer bank will produce no resultant flux in the relay cores. The failure of a power transformer winding will change the ratio between the currents in the secondary circuits of the current transformers on both sides of the transformer bank, causing the relay to function and disconnect the bank.

A relay installation is checked by reading the volts generated in the test-core winding when it is substituted for the different relay cores while the power transformer bank is carrying at least half rated load. These readings should be compared with the laboratory readings to determine whether or not an excessive resultant flux exists. When making this comparison the number

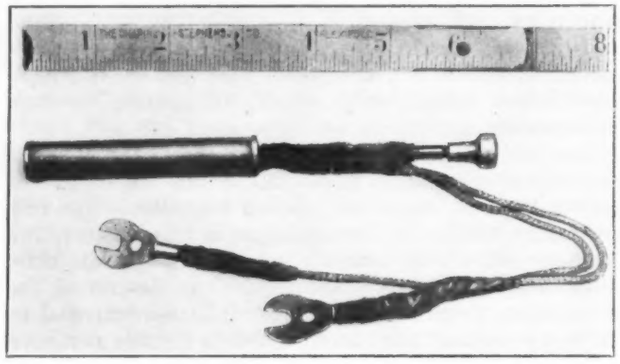


FIG. 3—TEST CORE USED FOR CHECKING DOUBLE-WINDING DIFFERENTIAL RELAY INSTALLATIONS

of turns of the laboratory relay and the current in it must be compared with the turns and current in the relay under test.

A zero voltage reading is hardly to be expected owing to the fact that there are a number of conditions which will produce a small resultant flux in the relay. Should a zero reading be obtained, a momentary deflection of the voltmeter pointer should be obtained by short-circuiting a relay coil to prove that the coils are carrying current.

If a comparatively large voltage reading is obtained, the entire relay installation should be gone over until the trouble is located. Whether or not the voltage readings represent a resultant flux large enough to cause trouble may be determined by comparison with the laboratory data, at the same time considering the magnitude of the current existing if the transformer bank were feeding a short circuit.

The test outlined above has, since its adoption by the Philadelphia Electric Company, been used to locate errors in relay installations which would have without a doubt caused them to function incorrectly.

Checking High-Range Meggers With Low Resistances

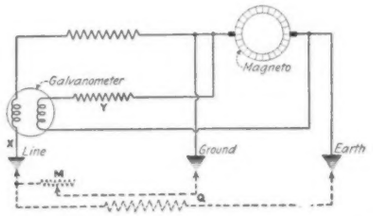
By Means of Shunting Resistances All Points of the Scale May Be Checked with Relatively Low And Inexpensive Resistance Units

BY RICHARD E. BROWN
Electrical Engineering Department, University of Pennsylvania

IN ORDER to check meggers which have ranges anywhere from 10 to 2,000 megohms, it would appear that a large number of standard resistances of unusually high values were required. Standard resistances in the order of 2,000 megohms are unusual and if made of wire would require several thousand miles of the smallest size. The method outlined in this article makes it possible to imitate the effects of these unusually high resistances by using standards of relatively low resistance.

The main parts of a megger are a high-voltage magneto and a differential galvanometer. The parts are arranged and connected as shown in the diagram. The terminals marked *line*, *guard* and *earth* are used in making connections for taking measurements and also in checking the instrument.

The method for checking the various points on the scale is as follows: The resistance of the circuit X of the galvanometer is determined by a Wheatstone bridge. To make this measurement the bridge is connected across the terminals marked *line* and *guard*. A standard resistance Q having a fairly large value, is connected across the terminals marked *line* and *earth* and a variable resistance, M, is connected across the terminals marked *line* and *ground*. Inspection of the diagram will show that circuit M is in parallel with circuit X. A definite fraction of the current flowing through Q is, therefore, shunted around the galvanometer. It is evident that by varying M the deflection of the instrument can be made anything desired. If the resistance Q is kept constant and M made equal to X, one-half of the current through Q flows through the galvanometer, and the indication of the instrument should be $2Q$. If M is made equal to one-nineteenth of X, the instrument indication should be $20Q$. By making M smaller and smaller it is possible to produce the equivalent effect of



METHOD OF CONNECTING MEGGER FOR TEST

very high resistances and to check the high points on the scale as readily as the lower ones.

A little reflection will show that the method is correct. Suppose the point on the scale corresponding to $20Q$ ohms were checked directly by connecting a standard of $20Q$ ohms between the terminals marked *line* and *earth*. The expression for the currents through the galvanometer circuits would be

$$I_x = V/(x + 20Q),$$

and

$$I_y = V/Y.$$

If this point were checked by the method suggested, the galvanometer currents would be

$$I_x' = I_q' - I_m' = \frac{V'}{(x/20 + Q)} - \frac{}{19}\,I_x',$$

$$I_x' = V'/(X + 20Q),$$

and

$$I_y' = V'/Y.$$

V and V' represent the terminal voltages of the magneto. These voltages, on account of different armature drops, are unequal and the currents I_x' and I_y' are less than the currents I_x and I_y respectively. Inspection of the formulas will show, however, that

$$I_x'/I_y' = I_x/I_y;$$

that is, the relative values of the currents are equal. The indication of a megger depends on the relative strengths of the currents in circuits x and y and is consequently the same for the direct method and the method suggested.

Tendencies in Rate Regulation

Disposition Is Seen to Concede on the Part of the Public That Revenues Must Be Adjusted as Fixed Costs and Operating Expenses Vary to Maintain a Fair Return on Capital

By L. R. NASH
Stone & Webster, Boston

THE regulation of public utility rates, like many other human activities, has been affected profoundly by the world war. Operating costs and fixed charges increased so rapidly that the commissions for the most part realized that long-drawn-out investigations were out of the question, if, in fact, they were needed at all in connection with the expansion of facilities and service so essential to victory. The public also was disposed to accept rate readjustments in the lighting and power field forced upon the companies by rising expenses, and it is noteworthy that so few expressions of hostility to coal clauses, war surcharges, new rate bases and the like came to the front. In the electric railway field the psychological aspect of a daily contact with increased rates has delayed popular accommodation to higher fares, but a gradual acceptance of their necessity is evident throughout the country.

It would be an error to assume that rate increases responsive to cost levels beyond the control of the utilities were ever welcomed by the consuming public, but the readiness with which such increases have been received in numerous cases the country over shows that some conception of what the utilities are struggling to overcome has lodged in the understanding of the man in the street.

It is as important for the investor to obtain a fair wage for the use of his capital as it is for the laboring man to receive an adequate reward for his services. The fall in the purchasing power of money means that to-day the investor must have nearly twice as many dollars capital wage as in the pre-war period, corresponding to increased remuneration for labor and to increased cost of materials and supplies. The larger net return due the investor can, I believe, be obtained more easily by increasing the valuation or rate base than by augmenting the percentage upon investment yielded by public utility operations. A significant acknowledgment of the necessity of recognizing that the rate base must be figured upon a new price foundation appears in a recent decision of the United States Supreme Court in Lincoln (Neb.) Gas & Electric Light Company vs. City of Lincoln et al. (250 U. S. 256).

Here the court notices judicially "that, primarily owing to the war, costs of labor and supplies have advanced greatly since the ordinance [relative to gas rates] was adopted, and largely since the case was last heard in the court below, and that annual returns upon capital and enterprise the world over have materially increased, so that what would have been a proper return for capital in gas plants and other public utilities a few years ago furnishes no safe criterion for the present or the future."

To-day it is easier to obtain recognition of 8 per cent as a minimum reasonable return than of 6 per cent in former times. In the Lincoln case above cited the court declined to declare a 6 per cent return prima facie evidence of non-confiscatory rates, pointing out that 8 per cent was the lowest rate generally sought and obtained upon capital invested in banking, merchandising and other business in the vicinity. Of course, there is room for a much wider appreciation of the need of a larger yield upon capital than in the past, and decisions of the foregoing tenor are both encouraging and helpful.

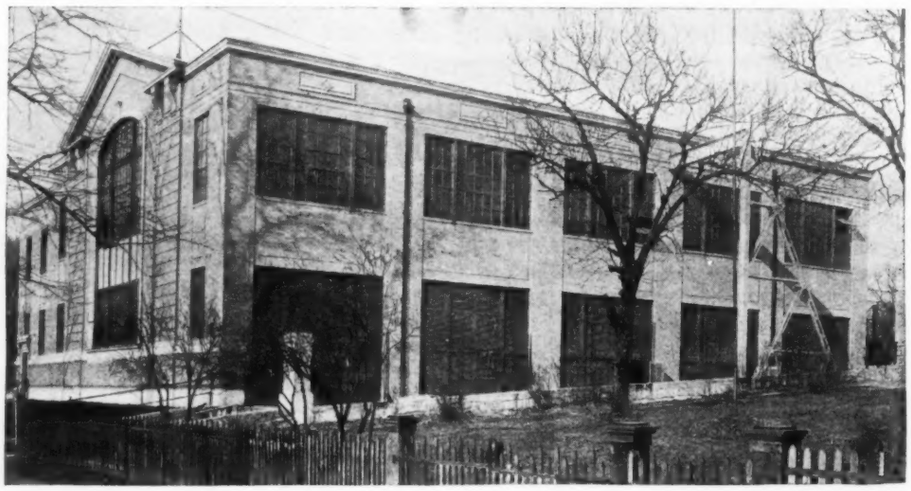
A tendency can be seen now toward giving greater consideration to intangibles in establishing the rate base. The commissions are not inclined to set value upon franchises apart from actual legitimate money outlays incurred in connection with their granting, such as legal expenses, cost of special elections, clerical work and the like; but development costs, expressed as deficits below a fair return upon the rate base in the early years of operation, are being recognized more appreciatively by the commissions. The study of depreciation is being continued, and better methods of handling the retirement of plant through the setting aside of a proper reserve out of earnings are in evidence. There is need of compiling accurate engineering data upon the life of equipment which at least will serve as a guide in the practical treatment of this subject. The war service of many plants has brought the subject of equipment life to the front and a wider public realization of the influence of depreciation as a factor in service maintenance is bound to come in time.

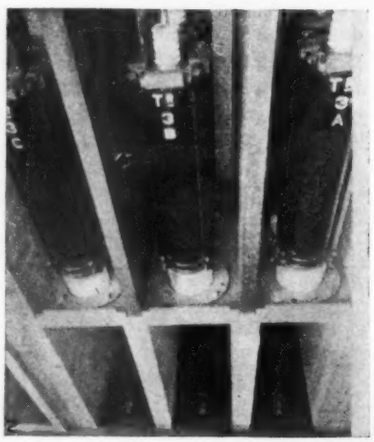
By and large, there can be seen a disposition to concede that revenues must be adjusted, as fixed costs and operating expenses vary, to maintain a fair capital wage. The policy of permitting utilities to initiate and establish new schedules of rates, subject to future revision if the regulatory body so determines, if more widely applied, will help to reduce the burdens carried by the utilities and release funds for service improvement.

One of the best things that could happen to the utility industry has transpired in this growing recognition, even if slow to function, on the part of the public and the commissions that in a time of changing values, rigid rate bases and fixed returns must give way to a flexible readjustment which will insure the public at a reasonable price the service which it demands and will need in future and insure the employee and the investor alike a fair wage for their co-operative contribution to the wants of the consumer.

THE *Edison spirit, which has been one of the most valuable adjuncts of the company in its wonderful growth, is based on the good old Golden Rule of doing unto others as you would have them do unto you and, thereby being kindly, courteous and helpful to the other people connected with the company.*—W. L. PERCEY, of *the Southern California Edison Company.*

Features of the New Substation at Flushing



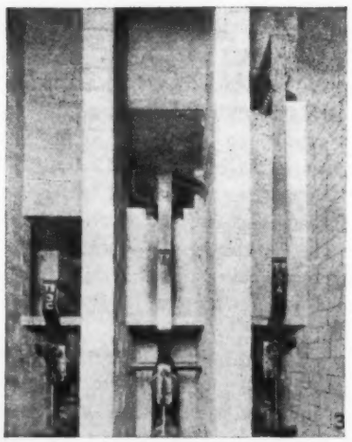


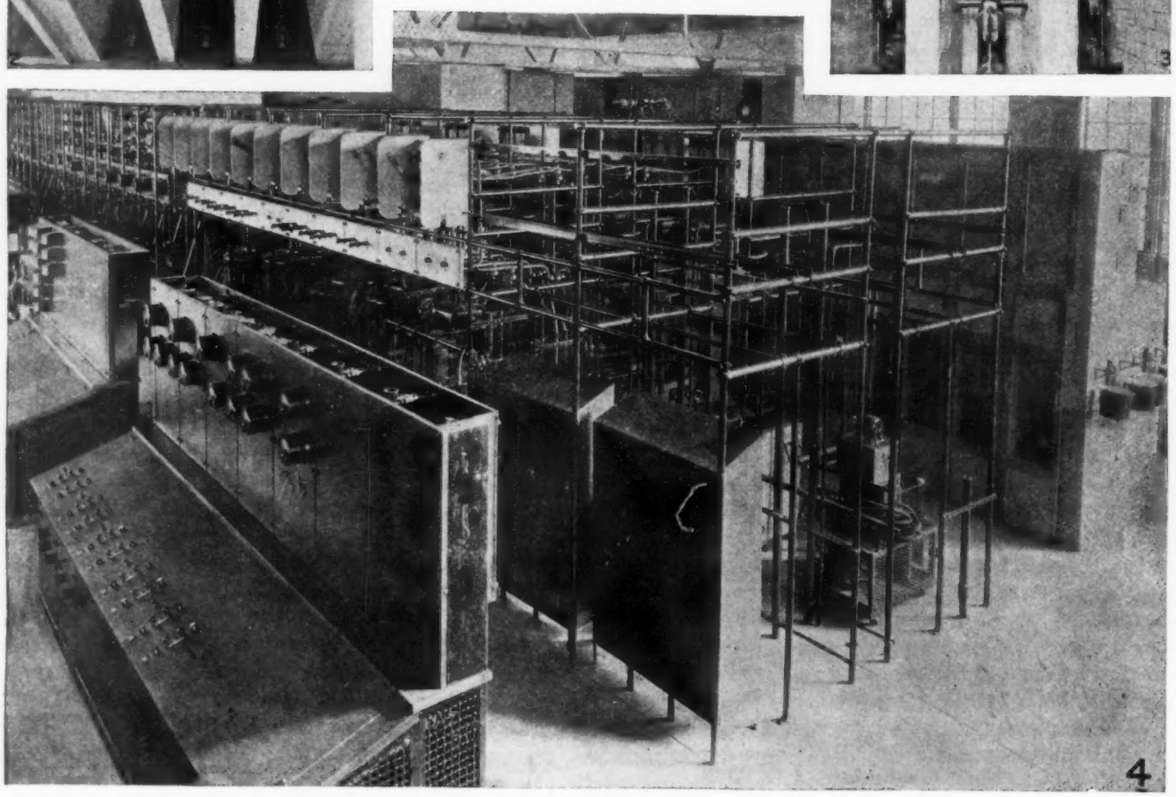
TYPICAL VIEWS OF FLUSHING SUBSTATION

No. 1—Large doors (below) to transformer compartments.

Nos. 2 and 3—Oil switch and disconnecting switch compartments showing lettering scheme.

No. 4—General view of switchboards and bus structure.





Features of New Substation at Flushing

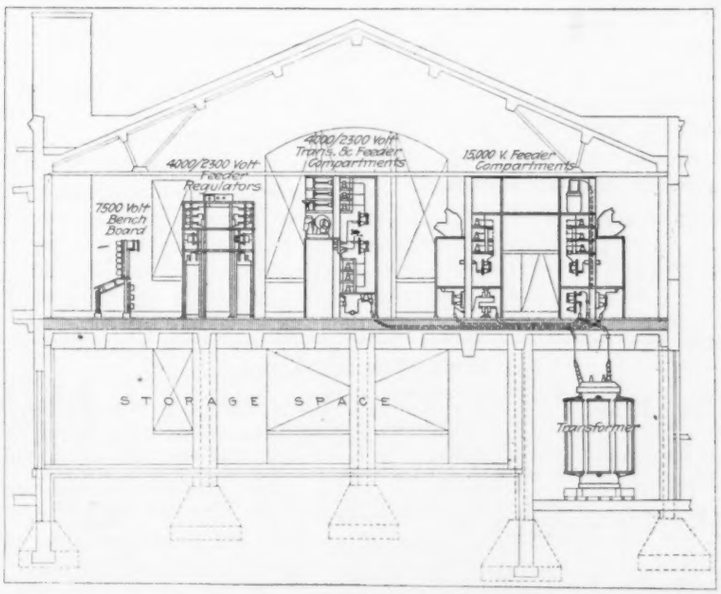
Serves a Scattered Load with Three-Phase, Four-Wire System and Street Lighting—Main Transformers Have Two Separate Secondary Windings or Buses at Different Voltages

By W. C. BLACKWOOD

Electrical Engineer New York & Queens Electric Light & Power Company

THE load in the territory supplied by the Flushing substation of the New York & Queens Electric Light & Power Company increased to such an extent in the last few years that the capacity of the station building and site was overtaxed and it was necessary to provide a new station which has just been placed in service. This substation building was designed to serve as headquarters for underground and overhead construction groups in the vicinity, and every facility has been provided for handling the necessary material as well as the substation equipment. Features of bus and building construction as well as the flexibility of electrical connection schemes are here described in some detail.

The increase in load was due not only to war business, but to a steady and rapid growth of industrial load, particularly in the College Point section. The old substation was erected in 1900 and served an area of approximately 45 sq. miles (115 sq.km.), including the towns of Flushing, College Point, Whitestone, Bayside, Douglaston, Little Neck, Corona and Elmhurst—all in the city of New York. The new substation is built on a piece of property 225 ft. x 325 ft. (68 m. x 99 m.) opposite the old station and extending through from Lawrence St. to Collins Pl. The building is a two-story combination storeroom and substation 94 ft. x 122 ft. (29 m. x 37 m.) There is a difference in elevation of 19 ft. (5.8 m.) between Lawrence St. and Collins Pl. and for this reason the substation was placed on the second floor and the storeroom, which requires less daylight, on the first floor. There is also a garage building on the same property and the remaining space is used as a storage yard.



SECTIONAL ELEVATION SHOWING TRANSFORMER COMPARTMENTS, FLOOR CONSTRUCTION AND OPERATING ROOM

Storeroom Supplies Construction Crews

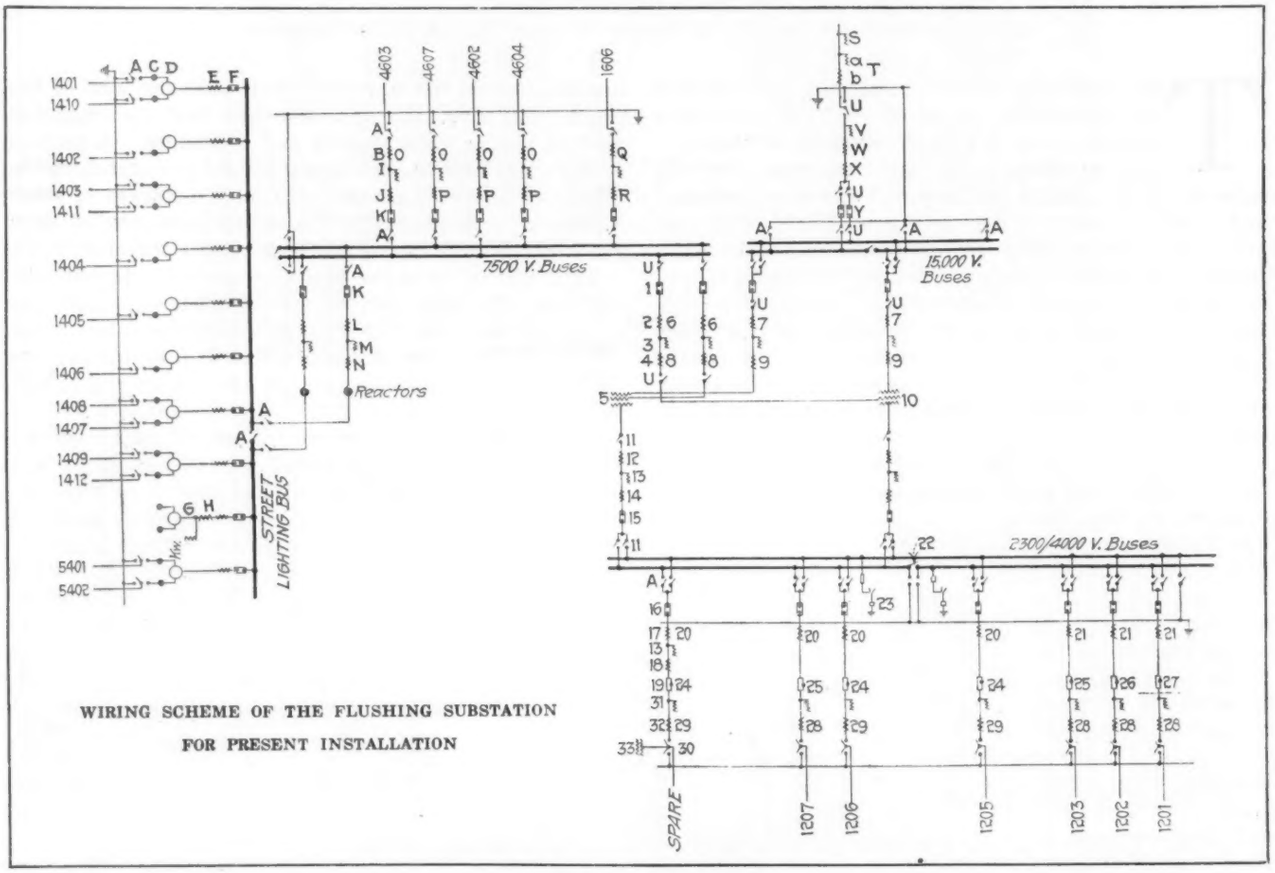
The storeroom is used for materials employed in overhead and underground construction in the district supplied by the substation. At one side of the building there is a covered shipping room in which the line trucks are loaded, and the storeroom floor is at the level of the truck platforms. Circuits are provided for charging electric trucks while loading and unloading. A portion of the storeroom is partitioned off for the storekeeper's office and steel bins are provided for the storage of small material. A 6-ton platform scale has been erected near the edge of the shipping platform, and a traveling hoist is arranged to serve the entire storeroom. In one corner there is a room for the accumulation of scrap wire and other material. On the same floor there is a room 20 ft. x 23 ft. (6 m. x 7 m.) which is used by the line gangs for miscellaneous work on rainy days and has in it lockers for the men's clothes.

The substation is designed for an ultimate capacity of 25,000 kva. with the possibility of extending the building for a considerable increase over that capacity. The present installed transformer capacity is 10,000 kva. The station is supplied at 15,000 volts by underground cables direct from the 201st St. generating station of the United Electric Light & Power Co. and is tied to the generating station and the other substations of the company by 7,500-volt, three-phase lines.

A one-line diagram on page 434 of the connections in the station. The ultimate 15,000-volt main bus is divided into four sections with one incoming and one outgoing line and one transformer connected to each section. The auxiliary bus is in one section. The 7,500-volt bus is arranged as a continuation of the 15,000-volt bus and is so designed that it may be changed over to 15,000-volt service at some future time when the use of 7,500 volts for transmission may be abandoned. The transformers are designed for three voltages, 15,000, 7,500 and 4,000, three-phase, with three electrically separate windings. The capacity of each transformer is 5,000 kva., which may be taken from any of the three windings. This design was selected for the first two units because of its flexibility and its economy, as a single three-winding unit acts as a spare for two ratios of transformation. Space

is provided in the station for four incoming 15,000-volt lines, four outgoing 15,000-volt lines four transformers (two 5,000-kva. and two 7,500-kva.), six 7,500-volt lines, ten 2,300/4,000-volt distribution feeders and twenty-eight series street-lighting circuits. The initial installation consists of one 15,000-volt line, two 5,000-kva. transformers, five 7,500-volt lines, seven 2,300/4,000-volt feeders and fourteen street-lighting circuits.

can be removed for the installation or removal of a transformer. There is an oil tank in a pit under the driveway which is connected by piping to all of the transformers, a pump in one of the transformer rooms being used to raise the oil from the tank into the transformers. Provision is also made in the piping for the connection of a portable oil-drying and filtering outfit. The switchboard, bus structures, feeder regulators and constant-current street-lighting transformers are on the second



WIRING SCHEME OF THE FLUSHING SUBSTATION FOR PRESENT INSTALLATION

KEY TO WIRING DIAGRAM

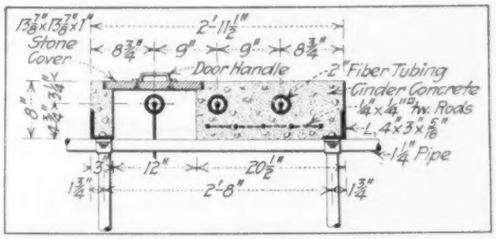
A—300A, 15,000-volt disc switch.
B—Cur. tr. for I.W., W.H.M., R.V.A.I., Am.
C—Circuit plugs.
D—Constant cur. trans.
E—K-28, 10A for O.L. relays.
F—K-5, 200A, 7,500-volt O.C.B.
G—BQ-4 pot. trans.
H—D-20, 10A cur. tr.
I—2P, 200W pot tr. for I.W., W.H.M., R.V.A.T., Am.
J—Cur. tr. for O.L. & R.E. rel.
K—H-3, 300A, 15,000-volt O.C.B.
L—3K-48, 100A cur. tr. for Am. O.L. & R.E. Rel.
M—2P, 200W pot. tr. for I.W., W.H.M., R.V.A.I., Vm.
N—2K-48, 100A cur. tr. for I.W., W.H.M., R.V.A.I.
O—2K-48, 200A.
P—3K-48, 200A.
Q—2K-28, 60A, 15,000-volt.
R—2K-48, 60A, 1-K-28, 60A.
S—3-P, 200W pot. tr. for ground relay.
T—United Electric Company (a) 2 pot. tr. for W.H.M., printometer; (b) 2 cur. tr. for W.H.M., printometer.
U—60A, 15,000-volt disc switch
V—2P, 200W pot. tr. for W.H.M., Vm., Wm.
W—2K-48, 300A cur. tr. for W.H.M., I.W., R.V.A.I.
X—3K-48, 300A cur. tr. for R.E. rel., Am.
Y—H-3, 500A, 15,000-volt O.C.B.
1—H-3, 500A, O.C.B.
2—Cur. tr. for diff. rel.
3—2-P, 200W, pot. tr. for W.H.M.
4—Cur. tr. for W.H.M., Am.
5—5,000-kva. transformer No. 4.
6—3K-48, 600A.
7—3K-48, 300A.
8—2K-48, 600A.
9—2K-48, 300A.
10—5,000-kva. transformer No. 3.
11—800A, 15,000-volt disc switch.
12—3W-2, 600A cur. tr. for I.W., W.H.M., R.V.A.I., Am.
13—2-200W pot. tr. for I.W., W.H.M., Vm., R.V.A.I.
14—3K-50, 2,000A cur. tr. for diff. rel.
15—K-52, 300A, 15,000-volt O.C.B.
16—K-52, 800A, 7,500-volt O.C.B.
17—3W-2 cur. tr. for O.L. rel., Am.
18—3W-2, 300A cur. tr. for I.W., R.V.A.I., W.H.M.
19—I.R.S. regulators.
20—300A.
21—150A.
22—2,000A, 15,000-volt disc switch
23—Lightning arresters.
24—F4, 200A, 46-kw.
25—F7, 100A, 23-kw.
26—F4, 90A, 20-kw.
27—F4, 100A, 23-kw.
28—100A.
29—200A.
30—300A, 2,500-volt disc switch.
31—2-P, 200W pot. tr. for I.W., W.H.M., Vm., R.V.A.I.
32—W-2, cur. tr. for L.D.C.
33—Station light and power.

The general arrangement of apparatus is shown in the section through the building on page 443 and the photographs on page 432. The transformers are installed in individual rooms on the first floor with doors opening onto a driveway. The doors are fitted with louvers for ventilation, and the entire door and frame floor. Offices for the district superintendent and his assistants and a locker room, toilets and shower bath for the station operators are also on this floor.

All lines enter and leave the substation underground, and there are conduit systems with large manholes on both sides of the station. The 15,000-volt and 7,500-volt cables enter pothead compartments in the transformer rooms. Metering and ground relay protection transformers are also installed in these compartments. From the compartments single-conductor cables are run to the bus structure in fiber conduits built in the floor. All conduits in the floor are placed in a space 12 in. (30 cm.) deep between the reinforced-concrete floor slabs and the finished concrete floor. The conduits were laid

on top of the floor slab in four levels to allow for crossing of the various runs. The vacant spaces were then filled in with hollow-tile blocks and concrete was poured into the smaller and irregular spaces between blocks. The 2-in. (5-cm.) finished floor was then laid on top of the blocks.

In order to group all of the switch controls, relays and instruments on as short a board as possible, the bench type of board was selected. Ammeters, voltmeters, reactive component indicators, wattmeters, etc., are placed on the front of the upper section, switch controls and voltmeter receptacles on the bench, calibrating terminals for the instruments on the lower front section and relays on the lower rear section. A special section for watt-hour meters was arranged in the rear of the upper section. Instruments in all General Electric horizontal edgewise, and switch controls are of the pull-button type. Westinghouse induction relays are used. For uniformity the street-lighting switchboard was also made a benchboard. On it are the controls for the oil switches on the primary of the constant-current transformers and the circuit ammeters. The plug switches



SECTION OF FEEDER REGULATOR BUS IN CONDUIT

on the secondary of the constant-current transformers are installed on small panels at the transformer structure. No short-circuit plugs are provided, as it has been found that they are not necessary on circuits feeding incandescent lamps only.

The bus structures are of light-buff pressed brick with horizontal shelves of Alberene stone. The phase barriers for 15,000-volt oil switches are also of Alberene stone. The structures are approximately 14 ft. (4.3 m.) high, but they are so designed that all disconnecting switches may be easily reached from the floor. Wire-glass panels are used in doors over compartments in which there are disconnecting switches or oil switches. In the other doors the panels are of asbestos wood. The switches on the 15,000-volt and 7,500-volt buses are General Electric type H-3, and on the 2,300-4,000-volt bus type K-52 switches are used. Single-pole switches are used on the three-phase grounded neutral feeders to localize trouble to one phase in the event of a short circuit or ground on that phase. All lettering and marking is placed inside of the compartments to prevent mistakes due to the interchanging of doors. The marks are so placed that they may be read through the wire-glass doors.

Each distribution feeder is equipped with three single-phase induction regulators, and a transfer bus is provided to allow the transfer of any feeder to a spare set of regulators or the tying together of feeders in case of regulator or oil-switch trouble. The transfer bus is run in fiber conduit incased in concrete on the top of an iron pipe structure.

In designing the lighting system for the operating room attention was given to providing good illumination in the switch compartments and to the prevention of reflection from the glass over the instrument dials. A totally indirect system was adopted with X-ray reflectors on the top of the bus structures and the benchboard. This arrangement provides lighting from totally concealed sources as not even the fixtures are visible. The lighting of the switch compartments is accomplished by using two intensities in this system. One intensity is sufficient for general illumination, and the higher intensity (obtained by switching on additional lamps) is used when illumination is needed in the compartments for disconnecting-switch operations or inspection of apparatus.

A fifty-nine cell, 40-amp.-hr. storage battery is installed for switch operation and emergency lighting. This battery is charged by a 5-kw. motor-generator set which runs continuously. The emergency lights are automatically switched onto the battery if the alternating-current source fails. A stationary vacuum cleaner has been installed with outlets at various points in the building, and rubber insulating nozzles are used for cleaning the apparatus.

The station was designed by the company's engineering division, and all apparatus was installed by the construction division.

Energy Consumption of Electrical Pumps in Copper Mines

AS PUMPING in the Michigan copper mines is a problem of high heads rather than of handling great volumes of water, the reciprocating pump has been found the most economical and only this class of equipment has been installed in recent years. However, both centrifugal and plunger pumps are in use.

ENERGY CONSUMED PER 1000 GAL. PER 1000 FT. OF HEAD

Shaft	Type of Pumps	Total Vertical Head	Shaft Angle in Deg.	No. of Pumps	Capacity of Pumps Gal.-Min.	Thousands of Gal. to Surface	Kw.-Hr.	Kw.-Hr. per 1000 Gal. per 1000-Ft. Head
A	Recip	2,090	38	3	400	11,105	112,000	4.8
B	Cent.	2,885	38	4	1,000	13,970	290,000	7.2
C	Recip.	2,230	70	2	400	84,334	835,740	4.6
D	Cent.	2,215	70	3	200	5,700	102,230	8.1
E	Recip.	2,200	70	3	200	16,693	355,700	5.6
	Cent.	1,400	70	2	200	18,614		

The work is done by pumps ranging in capacity from 200 gal. (756 l.) per minute to 2,100 gal. (7,950 l.) per minute, relaying the water from one storage reservoir to another and finally to the surface. Considering energy consumption, it is evident from the accompanying table that the reciprocating pumps are more economical for the work.

Shafts A and C in the table may be compared, one being a three-lift and the other a two-lift installation for about the same head, with pumps of the same rating. The two-lift installations show a slight saving in power. Shafts B and D are equipped with centrifugal pumps, the higher-rated pumps showing somewhat better economy. The relation between the reciprocating and centrifugal units shows a consumption of from 55 per cent to 75 per cent greater for the latter. As these figures are for actual operating conditions with all losses such as leakage from reservoirs included, the conclusion should not be reached that one type of pump is better than the other. Shaft E shows a combination, as both lines were operated from the same kilowatt-hour meter. Figures shown are for a period of one year.

Readers' Views and Comments

Generator Voltage Regulation

To the Editor of the ELECTRICAL WORLD:

SIR: The writer was much interested in the suggestion made by W. A. Darter of Brenham, Tex., on page 1011 of the Nov. 29 and Dec. 6, 1919, issues of the ELECTRICAL WORLD regarding misadjustment of alternator rheostats. But I think another suggestion should be added to apply when there is no automatic voltage regulator used and especially where the exciter and alternator have a common source of power so that the same speed variations affect both. In such installations it is generally the case that the engine is of smaller capacity, compared with the load fluctuations, than in the bigger and better-equipped plants, and therefore engine speed regulation is not so good, making better voltage regulation with regard to speed advisable even at the cost of some of the economy.

In several instances where voltage regulation was giving trouble the writer has found the exciter voltage very low, so low as to be well on the "steep side" of the "knee" of the exciter speed-voltage regulation curve, and the condition was bettered if not entirely corrected by using a 100-volt or 105-volt pilot lamp across the exciter brushes and instructing operators to keep it nearly up to normal candlepower by adjusting the exciter voltage with its rheostat and making further adjustments by use of an alternator rheostat.

This is another case where economy must be balanced against service. EMERSON A. ARMSTRONG.

Lincoln Motor Company, Detroit, Mich.

No Complaints of Ashes from Powdered Fuel

To the Editor of the ELECTRICAL WORLD:

SIR: Referring to the article in your issue of Jan. 17, 1920, on "Oil and Powdered Fuel for Central Stations," by C. H. Delany, the writer wishes to point out that the statement made by Mr. Delany in the latter part of his article that the ash which passes out through the chimneys with the stack gases is objectionable in the case of city plants is not borne out by facts in cases where pulverized coal is being used and has been used for considerable time in cities, particularly where the stacks are 150 ft. (45 m.) high or over.

The following extracts from letters which the writer has received from places where pulverized coal is being used under boilers speak for themselves on this question.

From a large public utility corporation (Oct. 2, 1919):

We have been burning 150 tons of coal per day for the last two years in a plant in the center of the city, one block from the City Hall and surrounded on all sides by the highest buildings in the city. We have received no complaints and can find around about here no evidence that would indicate that our ash descends anywhere in the vicinity. My own belief is that it is so finely divided as to make it extremely doubtful that it descends at all until such time as it takes up moisture. The ash itself, being free from all combustible, of course, is grayish-white and does not soil or blacken anything it touches.

From the Puget Sound Traction, Light & Power Company, Seattle:

There have been no complaints from any one in connection with this plant, which is in the heart of the city. The stacks are high and the ash undoubtedly floats away, and it is impossible even to see any amount of ash passing from the stacks.

From the New Richmond Hotel, Seattle:

As these parties have a high stack, there have been no complaints, even though they make a practice of blowing the tubes and combustion chamber, allowing all the ash, except what slags, to go out of the stack.

From the Broadway High School, Seattle:

They also blow a great deal of the ash out of the stack, but there is considerable of it collected in a long tunnel between the stack and the boilers, which they clean out about once a year.

From the L. C. Smith Building, Seattle, Wash.:

This building is forty-one stories high, and there have been no outside complaints from parties in that vicinity.

FULLER ENGINEERING COMPANY.
Frederick A. Scheffler, Manager Power Deparment.
Allentown, Pa.

Ground Wire on Transmission Lines

To the Editor of the ELECTRICAL WORLD:

SIR: The subject of a protective ground wire for transmission lines interests us greatly, and I should like to have our position made clear to the readers of the ELECTRICAL WORLD. We oppose its use vigorously, contending that better results will be obtained by putting an equivalent amount of money into additional insulation. Our reasons are based upon many years of observation, and many operating engineers hold the same opinion.

On the other hand, the arguments advanced for and against the ground wire are difficult to evaluate, chiefly because of the uncertainty regarding the protection which it affords. The simple mathematical theory is satisfactory, but, as I recall, does not take account of whether the circuit is grounded star or insulated delta. Electrostatically, the conductors of the former are at earth potential. On systems of the same physical dimensions what are the charges that can accumulate through atmospheric induction, grounded and insulated, with and without ground wire protection? Where the conductor arrangement is in vertical planes there is definite evidence that the top conductors shield the ones below and that voltage disturbances are more frequent on the top wires. How would this be affected by transposition?

If a miniature line, perhaps a hundred feet long, were constructed beneath an insulated metal plate or screen and high frequency, of the order of 300,000 cycles, were applied between the plate and ground, the charging currents could probably be measured by milliammeters, which are readily available and of good accuracy. From calculated capacitances the potentials could be determined.

The method described has occurred to me as of possible value for demonstration and for checking calculated relations. W. A. HILLEBRAND.

Ohio Brass Company, San Francisco, Cal.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

One-Pole Ladder Facilitates Street-Lamp Inspection

TO AVOID the use of the conventional double-pole ladder for inspecting reflectors and replacing the incandescent bulbs on the fixtures lighting the water front of San Francisco, an inspector employed by the Harbor Board devised the ladder shown in the illustration. Formerly it was necessary for the inspector to carry a large ladder from the nearest dock, if one was available. Sometimes none was, and in any event the work of carrying the ladder was heavy.

The special ladder weighs only a few pounds and is carried by the inspector from pole to pole. At the top of the ladder there is a hook which fastens to the scroll work near the top of the fixtures. The bottom of the ladder is strapped to the fixture at a point about 3 ft. (0.9 m.) from the ground to hold it steady while the inspector is climbing and to protect it from being struck by a passing motor truck, which might throw the inspector from his position.

C. W. GEIGER.

San Francisco.

Moisture Is Cause of Generator Breakdown

SOME time ago a generator in a power plant failed, the cause apparently being the failure of the insulation from deterioration. The generator was drawing its cooling air from outside, and the end shields formed part of the air ducts to and from the winding. The outside temperature previous to the breakdown was very low, and the temperature of the duct through which the air entered was virtually the same. The engine-room temperature was 30 deg. F. above the temperature outside, and the amount of steam leakage was not excessive. However, a large amount of moisture was deposited on the inlet shield owing to the engine room being cooled by it below its 100 per cent humidity temperature. This moisture went through the shield joints, the faces of which were very porous, and fell on the windings, ultimately breaking down the insulation.

The end shields of the turbo-generators are made in halves so that there is a circumferential joint to the shell of the machine and an axial joint at the top where the two halves butt. The circumferential joint was made with a spigot, and there were blow holes in the castings so that the joints were not watertight. These blow holes were filled up with a soft jointing compound, and the faces were afterward filed flush. When the end shield had been fitted the joint edges were sealed with a very small quantity of the same material. This proved to be perfectly watertight, and after months of service there is no crack in the outside seal.

It was not considered advisable to use a soft jointing compound between the faces, as there would have been danger of a portion being squeezed out and dropping on the windings.

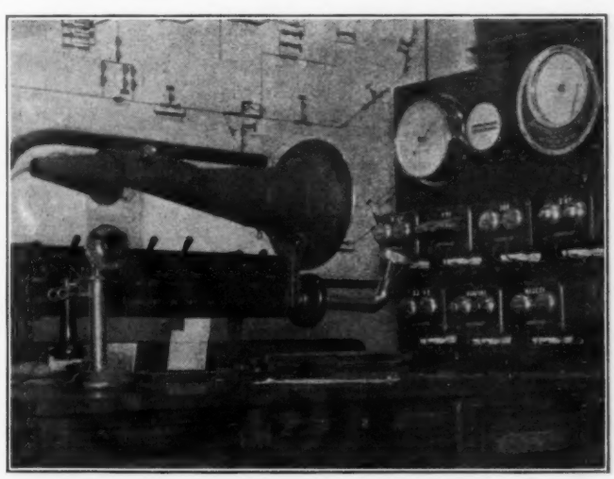
MARK MEREDITH.

Liverpool, England.

High-Power Telephone for System Dispatching

PRIVATE telephone systems maintained by power companies for the operation of their system and the transaction of company business are very often subject to inductive interference from their own power lines. In some cases these private telephone lines are carried along directly beneath the high-voltage lines and on the same poles. Usually the lines are transposed, and "bleeder" transformers are used to drain them of transient disturbances and to maintain a balanced potential at all times. These measures are very effective, but they never entirely clear a line.

Up to several years ago the power companies had to be content with the ordinary telephone apparatus on the market. This apparatus, while designed for a different class of work, generally less severe, gives fairly good service on comparatively quiet lines. However, when the lines are very noisy and important business is to be carried on, such as load dispatching and switching, it is important that the transmission should be very clear.



MEGAPHONE RECEIVER AMPLIFIES SOUND

In October, 1918, the San Joaquin Light & Power Cor-

poration installed in their dispatchers' office a high-power telephone. There are no new principles involved in this instrument, but it is a telephone set on a big scale, designed to transmit a greater volume of power and to amplify greatly the received energy. With this set it is practicable to talk over very noisy lines and over greater distances on comparatively clear lines than was ever possible with the ordinary telephone instrument. The energy for this set is supplied by an automobile-type storage battery, which is charged occasionally by a small Tungar rectifier. The whole installation has proved a successful solution of a rather annoying problem.

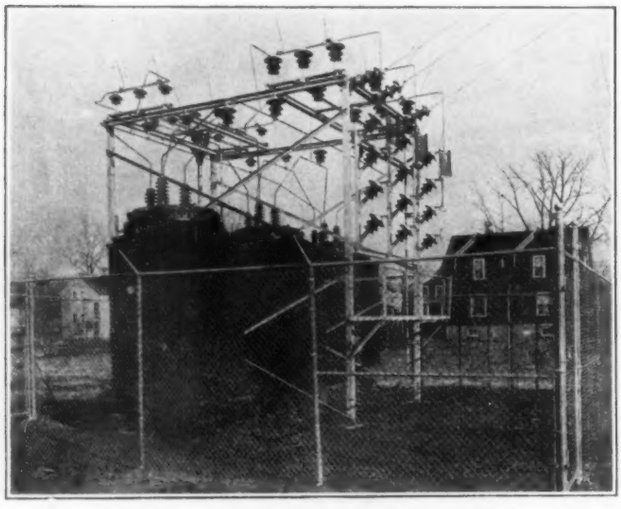
Another feature of the set worthy of note is the reduction of the "raps in the ear" which it is possible for the user to get. The standard telephone receiver, when held tightly to the ear, as is necessary when listening over a line exposed to inductive interference, causes the user to receive a painful and often dangerous injury to the eardrum at the time of an occurrence such as a short circuit on the power system. This set, by the introduction of an air cushion in the funnel, prevents any such danger.

R. C. DENNY,
Operating Department.
San Joaquin Light & Power Corporation,
Fresno, Cal.

Outdoor Substation Built at Low First Cost

LOW first cost and compact arrangement are the features of the substation shown in the accompanying illustration. This equipment comprises a 12,000/33,000 volt step-up station and its cost was only $4 per kva. The primary side of the station is connected to a 12,000-volt underground feeder, and the secondary feeds a 33,000-volt urban line.

With its arresters the station occupies a ground space of 27 ft. x 32 ft. (8 m. x 10 m.) inclosed by a wire fence.



OUTDOOR SUBSTATION FOR URBAN SERVICE

The tower, assembled from steel-galvanized sections, carries the following equipment: One three-pole remote-controlled air-break switch on the incoming 12,000-volt bus, one switch of similar design on the 33,000-volt outgoing bus, three single-pole combination choke coils, disconnecting switches and fuse mountings, one oxide-film lightning arrester, three 1,633-kva. single-phase transformers and a few busbar supports for holding the copper-tube buses.

There is no automatic overload protection on the substation, as the supply end of the underground 12,000-volt feeder is equipped with an automatic oil switch. The three-pole switches are operated from ground level by means of handles which can be locked in either open or closed position, and the choke coils are connected in the outgoing leads on supporting bases which also carry the disconnecting switch with limit fuses in the lightning-arrester circuit. These "disconnects" can be opened and the arresters disconnected without interfering with the load service.

The transformers and arresters were furnished by the General Electric Company, the remainder of the material by the Delta-Star Electric Company.

Synchronous Effect of Two Parallel Transmission Lines*

AN INTERESTING phenomenon has been observed in the case of a tie-in between the lines of the Southern Sierras Company, which operate at 60 cycles, and those of the Southern California Edison Company, which operate at 50 cycles.

Circuit No. 1 of the tower line of the Southern Sierras Power Company was in use at the time for transmission at 90,000 volts between the generating plants on Bishop Creek and the San Bernardino substation. This circuit was also tied in with the Southern California Edison system through a 6,250-kva. frequency changer set at the Edison Company's Colton substation.

Circuit No. 2 of the tower line was to be used temporarily as an emergency connection between a 10,000-kva. generating plant at the northern end of the line and a 55,000-volt transmission line leaving the San Bernardino substation, the reason for this connection being that one of the three-phase, 88,000/55,000-volt, 4,000-kva. transformers at the San Bernardino station was out of service and there was insufficient transformer capacity remaining to carry the 55,000-volt load at the station.

Circuit No. 2 was energized by the hydro-generating plant and was to be synchronized at the San Bernardino substation with circuit No. 1 through the three-phase transformers mentioned. As the frequency of the incoming plant approached that of the 60-cycle system it was observed that the pointer of the synchroscope showed a tendency to slow down when passing the 180-deg. out-of-phase position and swung rapidly past the point denoting phase coincidence. When the frequencies of the two systems became equal the instrument came to a stop with the pointer 180 deg. away from "in-phase" position. No significance was attached to this by the operator at the time, but when the condition prevailed for several minutes an investigation was made on the assumption that something had gone wrong with the instrument or instrument wiring. After checking these and finding that they were all right on other synchronizing transformers, it was noticed that the frequency of the incoming circuit remained fixed as though tied in with the remainder of the system.

Communication with the incoming hydro-electric plant

*Presented by R. H. Halpenny at a meeting to consider operating difficulties at the Pacific Coast convention of the A. I. E. E.

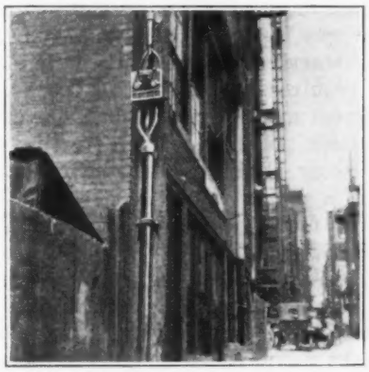
followed, and it was learned that the operator there was puzzled as to why the line had not been synchronized during the long period in which his plant had held a steady speed at normal frequency, for he had not seen the other switchboard indications that would show that his plant was synchronized in the usual way with the other line. During this interval the system frequency had varied half a cycle either side of 60, and the frequency of the incoming plant made a corresponding change.

By this time the San Bernardino operator came to the conclusion that the phenomena was due to the mutual action of the two tower-line circuits, and he instructed the hydro-plant operator to increase or decrease the water on the waterwheel until his plant broke away from the system frequency, after which he was to return to the former condition as nearly as possible. This had the desired effect in that the hydro-plant soon dropped out of step with the system, not without a marked inductive effect, however, for a series of voltage swings from 5 per cent below to 5 per cent above normal was observed as the frequencies became different. Needless to say, the operator when synchronizing was careful to "make a shot" with a rapidly swinging synchroscope pointer when the plant again approached the frequency of the system.

This same action was since noticed on other occasions when it has been necessary to synchronize under similar conditions, in one instance with a different plant on the incoming circuit.

Entrance of Moisture to Cable Prevented by Means of Tap

AS MANY cable failures are due to the entrance of moisture into the insulation, care must always be taken when tapping cables to make splices waterproof. The Kansas City Light & Power Company has developed a method shown in the accompanying illustration, that



LEAD CAP PREVENTS ENTRANCE OF MOISTURE AND SUPPORTS CABLE

entirely overcomes the problem. This connection between underground and overhead circuits consists of three single-conductor, 300,000-circ.mil, 600-volt rubber-and-lead-covered cables in a 3.5-in. (88 mm.) iron conduit. In the manhole these cables splice into one three-conductor, 500,000 circ.mil. paper-and-lead-covered cable; on the pole they terminate in a three-pole weatherproof cut-out and junction box. The lead cap at the top of the conduit furnishes support for the cables and also serves to keep water out of the pipe. Each conductor, where it leaves the top of the conduit, is wrapped with alternate layers of white linen and P. & B. paint, and the crotch is filled with solder to seal the conduit against the entrance moisture.

Above the cut-out is an older method of cable construction with a three-conductor cable. This method, however, does not prevent the entrance of moisture into the cable, especially when the "Y" is inverted. The engineers have found it practically impossible to keep moisture out of the "Y" branch when the crotch is exposed to the rain.

D. D. CLARKE.
Kansas City (Mo.) Light & Power Company.

Data and Results of Steam Power Plant Test

IN ORDER to determine the economy in terms of kilowatt-hours per pound of oil of a unit recently installed in the Lake Union plant of Seattle, a complete boiler test was made by J. D. Ross, superintendent of lighting. The unit tested is the second one installed in the plant, and it consists of four 823-hp. Stirling boilers supplying an Allis-Chalmers steam-turbo unit of 12,500 kw. capacity. Data on and results from this test are given herewith. It is seen that 0.775 kw.-hr. was obtained for every pound of oil fired. In addition, the thermal efficiency of the plant was found to be 14.64 per cent and the combined efficiency of boilers and furnaces to be 82.76 per cent.

REPORTS OF TEST OF STEAM PLANT

DESCRIPTION OF APPARATUS

Four 873-hp. Stirling safety water-tube boilers.
Four Foster superheaters.
Thirty-two Cochrane water heaters of 200,000 per hour rated capacity each.
One 12,500-kw. Allis-Chalmers-Parsons turbo-generator unit.
Peabody-Hammel oil furnace: Water heating surface, 8,226 sq.ft.; superheating surface, 755 sq.ft.
One 12,500-kw. Allis-Chalmers-Parsons turbo-generator unit.
Auxiliaries driven by induction motors or impulse steam turbines, or by both.
Exciter driven by steam turbine and fuel-oil pumps driven by reciprocal steam engines.
Type of condenser, Wheeler rectangular jet.
Capacity of condenser:

Gal. per Minute	Lb. Steam	Vacuum In.	Vacuum Deg.	B.-Hp. Water
11,000	150,000	28.5	60	290
11,000	200,000	27.5	60	290
11,000	100,000	28.85	60	290
11,000	50,000	29.0	60	290

Duration of test, eleven hours, with turbine running continuously.

AVERAGE PRESSURE AND TEMPERATURE

Steam-pipe pressure near throttle by gage, lb	183.7
Steam pressure, turbine inlet after throttle, lb	171.2
Vacuum in condenser, inches of mercury	28.74
Temperature at throttle (includes superheat), deg. F.	506.0
Temperature feed water entering boilers, deg. F.	183.6
Temperature of escaping gas leaving boilers, deg. F.	481.8

HOURLY QUANTITIES OF COAL, WATER AND STEAM, AND RATES

Oil as fired per hour, lb	9,881.7
Equivalent evaporation per hour from and at 212 deg., lb	152,149
Calorific value of fuel: Proximate analysis as follows:	
Gravity, 15.4 deg. Baumé at 60 deg. F.	0.963
Water, per cent	2.9
Silt	None
Sulphur, per cent	100
B.t.u. (gross)	18,045
Correction of B.t.u., value for sulphur, B.t.u.	41.1
Average kw. output, gross	87,350
Auxiliary load, total kw.-hr.	3,086
(a) Auxiliary load, kw.-hr. per hour	280.5
(b) Auxiliary load, total kw.-hr.	2,869
(c) Exciter, kw.-hr.	217
Net kw.-hr. per hour	7,660.5

ECONOMY RESULTS

Kw.-hr. per lb. of oil as fired	0.7752
Kw.-hr. per bbl. of oil as fired	261.53
B.t.u. per barrel of oil as fired, 337.3 × 18,045 =	6,086,575
Kw.-hr. per bbl. of oil corrected to standard barrel of 6,216,000 B.t.u.	267.07
Heat units in oil consumed per kw.-hr.	23.315
Water evaporated per lb. of oil as fired, lb.	13.33
Water evaporated per lb. of oil as fired, from and at 212 deg. F., lb.	15.39

EFFICIENCY RESULTS

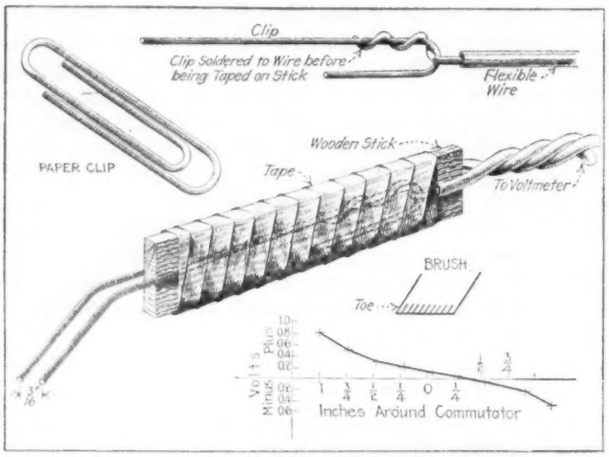
Thermal efficiency of plant, 3,415 ÷ 23.315 =	14.64	per cent
Combined efficiency of boilers and furnaces, based on oil as fired,	82.76	per cent

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

How to Determine Interpole Strength Curve

IN DETERMINING the correct strength and shape of interpole for direct-current machines the voltage curve should be obtained because the needed adjustments can be easily ascertained from this curve. This can be done by means of two metallic points insulated from each other and a low reading voltmeter, preferably from 3 volts to 5 volts full scale. The contact



DEVICE FOR DETERMINING VOLTAGE CURVE OF INTERPOLE AND CURVE AS DETERMINED BY TESTS

points which are made of springy steel wire (ordinary paper clips can be used) are bent in the form shown in the illustration and soldered to the voltmeter leads. They are taped together on a flat stick so that the points will be about $\frac{3}{16}$ in. (5 mm.) apart.

By holding these points lightly but firmly on the commutator while the machine is running under load and noting the voltmeter readings for a point ahead of, under and behind the brush it is an easy matter to plot the voltage curve. In plotting this curve inches are used for the horizontal distances and tenths of a volt for the vertical distances.

Group-Motor Drive Found Advantageous for Light Work

AFTER a thorough study of possible operating conditions, the superintendent of motive power in a New England specialty factory recently found that group driving was the most economical as to both initial and operating cost. The experience of the establishment showed, for example, that for every 5 hp. in individual drives the same work could be satisfactorily accomplished by 3 hp. in group installation. As the machinery in this plant was not of the heavy type, the problem was whether it would be better to install a 3-hp. motor to drive a group of punches from a common line shaft or to equip each unit separately with a 1-hp. motor. Although the punches were all equipped with flywheels, the power-factor fell to 60 per cent or thereabout with individual driving, compared with 80 to 85 per cent in the group system. Low power factor was penalized by the electrical supply company in this case, and the energy consumption, though somewhat less with individual drive, did not offset the advantages of lower first cost, better power-factor and decreased wiring and control expense associated with the system.

Power Requirements of Machines in Bindery

Schedule Shows Ratings of Motors Installed for Driving Machines as Compared With Requirements Obtained From a Power Survey

IN CONSIDERING removal of its plant of 118 individual direct-current motor-driven machines to a locality where only alternating-current is obtainable, the J. F. Tapley Company, book manufacturers, New York City, made an extensive power survey of its equipment. Although the investigation was initated primarily to secure the necessary data for obtaining quotations for the new motors, the study developed the fact that several of the machines were not correctly motored. One instance of this incorrect motoring was the driving of two Smyth case-making machines of the same size by 1 hp. and $\frac{1}{2}$ hp. motors respectively (see item 57 in the accompanying table). The tests showed that a $\frac{1}{2}$ hp. motor is capable of driving this type and size of machine.

Another case brought to light was the Seybold smashing machine which, although being driven by a 5-hp. motor, required only 2 hp. for normal operation. The larger motor was installed because of the high power necessary for starting the machine. It has a large flywheel which requires a large starting torque. When alternating current motors are installed, one can probably be selected which will have a high-starting torque and still be rated only slightly above the running requirements. Such a motor would be desirable because of the low power factor which would be entailed if the machine were overmotored.

In the present plant an effort has been made to standardize, as much as possible, on the sizes and makes of motors installed. In this way if the motor of one machine breaks down, it can be quickly replaced by one on a machine not in operation. Of course this procedure cannot be carried out to any extent when alternating-current motors are installed on account of the power factor.

Later it is the intention of the company to record the data shown on cards so that the information can be used and changed more easily. The chart, however, has served its purpose for comparison of machines and serves as a permanent record of requirements of the various machines. R. E. PETERS, Works Engineer.

New York, N. Y.

DETAIL MACHINE AND MOTOR SCHEDULE OF J. F. TAPLEY CO.

Ref. No.	Machine	Motor Equipment								Motor Control Apparatus			Driving Equipment					Max. Mach. Pulley Dia. Allowable	Machine Motive Data			New Motor H.P. Recomm.
		H.P.	Volts	Marked Speed R.P.M.	Actual Speed R.P.M. Max.	Actual Speed R.P.M. Min.	Winding	Type or Form	Manufacturer	H.P.	Style	Manuf.	Drive	Motor Pulley Face	Motor Pulley Dia.	Machine Pulley Face	Machine Pulley Dia.		Machine Drive Shaft-speed Max.	Machine Drive Shaft-speed Min.	H.P. Req. Equip. Loaded	
1	Dexter cutter (50 in.)	3	230	1150	1160	...	C.	L. Frame 3, Form A.	Stanley, G. I.	3	S. R.	C. H.	B.	4	4½	4	20	35	320	....	3	3
4	Dexter cutter (44 in.)	3	230	1150	1145	...	Sh.	L. Frame 3, Form A 2.	Stanley, G. I.	3	S. R.*	C. H.	B.	4	5	4	20	34	300	....	2	2
6	Duplex trimmer—Seybold	3	220	1050	1100	...	C.	Universal	Jenney	3	S. R.	C. H.	B.	4	5½	4	26	34	490	....	3	3
8	Corner cutter—Seybold	1	230	1450	1500	...	Sh.	G 302.	Diehl	1	S. R.	C. H.	B.	3	3¼	2	24	24	145	....		
9	Corner cutter—Seybold	¾	220	900	850	...	Sh.	D	Watson	1	S. R.	C. H.	B.	3	5	2	24	24	40	....		
10	Corner cutter—Hickok	¾	230	490	440	...	Sh.	G 302, E.S.J. 3022 L.	Diehl	¼	S. R.	C. H.	B.	3	3½	1½	16	16	100	....		
11	Dexter D 16, point feed folder	1	230	550	580	450	Sh.	L. Frame 2, Form A 199.	Stanley, G. I.	½	R. R.	C. H.	B.	2½	2	3	8½	8½	180	130		
12	Dexter single fold, 24 in.	1½	230	1400	1450	900	Sh.	C.A. Class 2.	General Elec.	½	R. R.	C. H.	B.	3	3	4	11½	11½	375	270		
13	Dexter D 16, point feed folder	1	230	550	....	....	Sh.	Frame 2, A 199	Stanley, G. I.	1	C. S. R.	C. H.	B.	3½	4½	4	11	11	290	210		
14	Dexter drop roll folder, D 16	2	230	1150	1300	930	Sh.	L. Frame 2, A 20	Stanley, G. I.	2	S.S.S.R.	C. H.	B.	3½	3¼	3½	16	24	280	200	2	2
17	Dexter suction feed single fold	1	230	1275	1400	1050	Sh.	C 2, A 74	General Elec.	1	R.R.	G.E.	B.	3½	4	2½	10	16	600	460	1	1
18	Chamber D 16-D 32, 4-fold folder	2	230	1150	1440	800	C.	Frame 2, A 26.	Stanley, G. I.	2	S.S.S.R.	C. H.	B.	3½	3	4	10	16	470	270	2	2
19	Chamber quadruple, 16-page folder	2	234	1100	1180	...	C.	.....	Fidelity	2	S. R.	C. H.	B.	3½	4	3½	10	22	510	....	2	2
21	Chamber drop roll jobber	2	230	1150	1100	700	C.	2, A 26	Stanley, G. I.	2	R. R.*	C. H.	B.	3½	3½	3½	9½	9½	400	260	2	2
23	Chamber drop roll jobber	2	230	1150	1100	...	C.	2, A 26	Stanley, G. I.	2	S.S.S.R.	A.S.C.	B.	3½	3½	3½	10	10	320	....	2	2
24	Chamber D 16, point feed folder	1	230	550	550	...	Sh.	L. Form 2, A 199	Stanley, G. I.	2	S. R.*	C. H.	B.	3½	3½	3½	8	8	280	....		
25	Belmont 3-fold point feed folder	¾	230	600	770	...	Sh.	I. L. 8.	Hawthorne, W. E.	2	S. R.*	C. H.	B.	2½	2½	3½	10	10	200	....		
26	Brown single folder	¾	230	1725	1900	700	Sh.	G 300	Diehl	¾	F. R.	C. H.	B.	1½	1½	2½	14	14	270	120		
27	Anderson single folder	1	230	1335	1440	410	Sh.	Frame 1, A 2	Stanley, G. I.	¾	C.S.R.	C. H.	B.	3½	4	3½	22	22	290	180		
28	Booth power folder	½	230	600	800	...	Sh.	.....	Fidelity	¾	S. R.	C. H.	B.	Grove	3½	Grove	9½	9½	400	....		
29	Seybold smashing machine	5	230	1150	1200	...	C.	Form A, Frame 5	Stanley, G. I.	5	S. R.*	C. H.	B.	5	3½	5	30	30	150	....	5	5
31	Seybold book compressor	2	230	1150	1140	...	Sh.	Form A 20, L. Frame 2.	Stanley, G. I.	2	S. R.*	C. H.	B.	1½	2½	3½	36	36	250	....	2	2
32	Thompson "Laureat" press	1½	230	850	1300	650	C.	Form D, Lundell R.T.	Sprague, E.	1	T. L. S. S. / R. R.	E.C. & M. / C. H.	B.	4½	5	3½	23	23	275	150	1½	2
36	Sheridan Embossing press	2	230	1150	1360	1200	C.	Form A 26, L. Frame 2.	Stanley, G. I.	2	C. S. R.	C. H.	B.	3½	3½	4	18	18	300	280	2	2
41	Rubbing-off machine	1	230	1275	1275	...	Sh.	Form A 74, Type C.Q.1.	Western, E.	1	T. L. S. S.	C. H.	B.	3½	1½	3½	8	14	410	....	1	1
42	"Buffalo" rubbing-off blower	2	230	1150	1180	...	Sh.	Form A, L. Frame 2.	Stanley, G. I.	2	S. R.*	C. H.	B.	3½	6½	3	4	8	2000+	1965	2	2
43	American gold laying machine	¾	230	1900	1900	...	Sh.	Size B, Type C.M	Crocker-Wheeler	.....	.....	.....	B.	1½	2	1½	7	8	580	....	¾	¾
49	Crawley power, rounding and backing machine	2	230	1160	....	....	Sh.	Form A 20, L. Frame 2.	Stanley, G. I.	2	R. R.*	C. H.	G.	2	2½	2½	37½	37½	76	73	2	2
53	Gulberg & Smith gathering machine	3	260	1150	1200	920	Sh.	L. Frame 3, Form A 2.	Stanley, G. I.	3	R R.	C. H.	B.	4	5	4½	18	18	330	130	3	3
54	Marresford automatic tipping machine	¾	235	800	850	...	Sh.	G 302.	Diehl	¾	S. R.	C. H.	B.	5	2½	2½	10	Spec.	240	....	¾	¾
56	Seybold rotary board cutter (42 in.)	1	230	515	570	...	C.	L. Frame 2, Form A 26.	Stanley, G. I.	2	S. R.*	C. H.	B.	3½	3½	4	24	36	82	....	1	1
57	Smyth case-making machine	¾	230	600	670	500	Sh.	R.T. 1 Lundell, Form D.	Sprague, E.	¾	C. S. R.*	C. H.	B.	2	3½	1½	10	Spec.	250	100	¾	¾
60	Cover bender	¾	230	600	780	...	Sh.	P.	Fidelity	¾	S. R.	C. H.	B.	2½	2¾	2¾	10	10	140	....	¾	¾
61	Latham Monitor multiplex punching machine	¾	230	600	640	...	Sh.	Form E.S. & F. 3012 A, Type G 301.	Diehl	¾	S. R.	C. H.	B.	3¼	2¾	3¼	15	15	145	....	¾	¾
62	Frohm Simplex stripping and reinforcing machine	½	230	1200	1500	1250	Sh.	.....	Fidelity	½	F. R. / T. L. S. S.	E.C.& M. / E.C.& M.	B.	2	6	1½	5½	5½	32	28	½	½
63	Smyth casing-in machine	1	230	1000	1290	1040	Sh.	.....	Fidelity	1	F. R. / T. L. S. S.	E.C.& M. / E.C.& M.	B.	3	2¾	1½	10	Spec.	350	300	1	1
64	"Isaacs" glue machine (16 in.)	¾	230	700	900	...	Sh.	GS 299	Diehl	.....	.....	.....	B.	Grove	1¾	Grove	6	6	250	....	¾	¾
68	"American" wringer machine (16 in.)	¾	235	600	660	...	Sh.	G 301	Diehl	¾	T. L. S. S.	C. H.	B.	2½	2¾	2½	11½	11½	140	....	¾	¾
72	Smyth cloth cutting machine	¾	230	850	960	...	Sh.	G 401	Diehl	.....	Snap	.....	B.	3½	3	1⅞	13	Spec.	240	....	1	1
73	Sawyer leather measuring machine	¾	220	600	800	...	Sh.	P. E	Fidelity	¾	S. R.	C. H.	B.	2½	1¾	2¾	15	.....	90	....	¾	¾
74	Fortuna skiving machine	¾	230	1725	1900	...	Sh.	G 300	Diehl	.....	Snap	.....	B.	2½	2¾	1½	3½	Spec.	2600	2400	¾	¾
75	Smyth sewing machine	¾	115	700	800	750	Sh.	299.	Diehl	.....	F. R.	C. H.	B.	2	2½	1½	7	Spec.	250	80	¾	¾
91	Smyth sewing machine	¾	240	600	690	650	Sh.	G 301	Diehl	.....	F. R.	C. H.	B.	2½	1¾	1⅞	10	Spec.	150	120	¾	¾
96	Smyth sewing machine	¾	220	700	980	850	Sh.	G 299	Diehl	.....	F. R.	C. H.	B.	1½	1¾	1½	12	Spec.	160	125	¾	¾
97	Singer sewing machine	¾	220	1800	2000+	1000	C.	551.	Diehl	.....	T. C.	C. H.	B.	Grove	1¾	Grove	3	Spec.	900	550	¾	¾
103	Singer sewing machine	¾	230	1450	1500	...	C.	G 300	Diehl	¾	S. R.	C. H.	B.	2½	3	3½	14	Spec.	340	....	¾	¾
105	Latham monitor wire stitcher	¾	230	600	680	...	...	G 302	Diehl	¾	S. R.	C. H.	B.	2½	2½	2½	13½	Spec.	160	....	¾	¾
106	Gould-Eberhardt shaper	2	230	500 / 1500	720	540	Sh.	R.R. 2, B-2	General El.	2	C. S. R.	C. H.	B.	3½	4½	3½	10	22	350	260	2	2
107	Foote-Burt universally adjustable drill	½	230	1200	1200	...	Sh.	P.	Fidelity	½	S. R.	C. H.	B.	2½	2½	3½	6	11	610	....	¼	½
108	Putnam engine lathe	2	230	500 / 1500	1580	500	Sh.	C. R. 2, Form B 11.	General El.	A5	R. 75 / Controller	G. E.	G.	½	2¼	1⅛	10	Spec.	112	32	2	2
109	Emery wheel	¼	230	1500	1580	...	....	Form R.T. 25, Type Lundell	Sprague	¼	S. R.	C. H.	B.	1½	2½	1½	2⅜	6	1900	....	⅛	⅛
110	Bridgeport heavy auto. knife grinder	3	230	1100	1100	...	Sh.	C.Q. 3, Form A 20.	General El.	3	S. R.*	C. H.	B.	4¼	7	7	23¾	23¾	340	....	3	3
111	Gang sawing-out machine	2	230	1150	1100	...	Sh.	Frame 2, Form A 2.	Stanley, G. I.	2	S. R.*	C. H.	B.	3	5½	3¼	4	10	1500	....	1	2
112	Minnich power baling machine	3	230	800	900	...	Sh.	.....	Fidelity	3	S. R.*	C. H.	G.	2½	3⅜	2	24½	24½	.....	.....	3	3
113	Fortuna skiving machine	¼	110	1700	1750	...	C.	Form L. B.	Ft. Wayne	.....	.....	.....	B.	1¼	2¼	1⅛	3¼	Spec.	2600	2400	¼	¼

KEY TO ABBREVIATIONS AND SYMBOLS USED IN ABOVE SCHEDULE

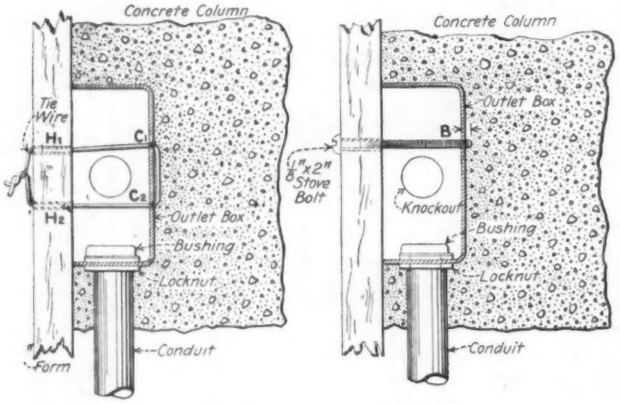
C. H. = Cutler Hammer Mfg. Co. G. E. = General Electric Co. A. S. C. = Automatic Switch Co. F. C. & M. = Electric Controller & Mfg. Co. N. E. C. C. = National Electric Controller Co. Sh. = Shunt C. = Compound. B. = Belt Drive. G. = Gear Drive. * = Magnetic Overload Release. Frict. = Friction Drive. Spec. = Special. T. C. = Treadle Controller. S. R. = Starting Rheostat. C. S. R. = Compound Starting Rheostat. R. R. = Regulating Rheostat. F. R. = Field Regulator. T. L. S. S. = Time Limit Self-Starter. S. S. S. R. = Self-Starting Speed Regulator.

NOTE—Manufacturers' serial numbers and Tapley numbers are also tabulated in the original table.

Side Outlets Fastened in Concrete Forms With Wire or Screw

DIFFERENT wiremen use different methods for attaching side-outlet boxes (for baseboard receptacles, switches, fan outlets, bracket outlets and the like) to the wooden forms before the concrete is poured. Two methods which are used frequently are shown. One involves the use of a piece of iron wire for fastening the steel box to the form. Old bailing wire will serve the purpose, but wire of smaller diameter will answer as satisfactorily. Two holes, H_1 and H_2, are bored through the form board, at the position where the box is to be attached. Then the box is tied securely in place by twisting the ends of the wire which extend through the holes. After the form has been removed, these wires can be severed with a pair of nippers at the points C_1 and C_2.

The second method shown makes use of a machine screw sufficiently long to extend through the form board



FIGS. 1 AND 2—WIRE AND MACHINE-SCREW METHODS OF HOLDING OUTLET BOXES IN PLACE

and into one of the tapped holes in the back of the box. The latter arrangement is better, more accurate and more economical where machine screws are at hand. Where they are not the tie wire will suffice.

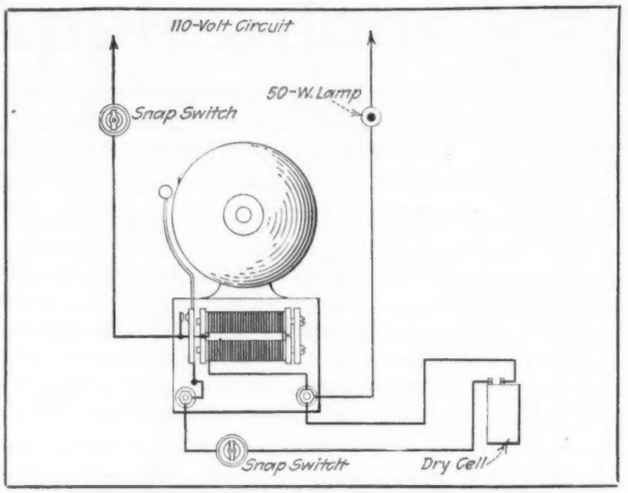
After the concrete has set and the forms have been taken down, the machine screws can be removed easily with a screw driver. They should never extend very far from the back of the box into the concrete. That is, the distance B in Fig. 2 should not be more than $\frac{1}{16}$ in. or $\frac{1}{8}$ in. (1.6 mm. or 3.2 mm.).

LYMAN L. AFTON.
Kansas City, Mo.

Ordinary Bell Indicates Condition of Circuit

WHEN used as an alarm to indicate that a source of energy supply has failed, the scheme illustrated has proved very dependable, simple and inexpensive. An ordinary iron-box bell is used, the coils being connected permanently in series with a 50-watt, 110-volt lamp to a 110-volt circuit. One dry cell is connected across the banding posts of the bell.

Under ordinary operating conditions, the current through the lamp is sufficient to keep the armature pulled against the pole pieces. When the armature is in this position, no current flows from the cell as the contacts are held open. If the main circuit is de-energized, the bell armature springs back against the contact breaker, thus closing the cell circuit and causing the bell to ring in the usual way. The hum produced on alternating-current circuits can be eliminated by mounting the bell on rubber or cork.

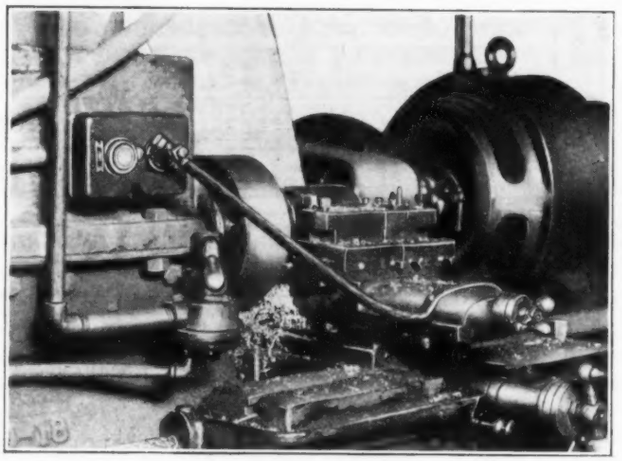


IF THE LIGHTING CIRCUIT IS DE-ENERGIZED, THE BELL WILL RING

C. C. MOLER,
Superintendent.
Northern Virginia Power Co.,
Winchester, Va.

Motor-Driven Lathe Stopped Automatically

BY THE use of the home-made automatic stop shown in the accompanying illustration one man is enabled to operate two Chard lathes in a New England shop. The lathe is driven by a 5.5-hp., 230-volt Westinghouse direct-current motor with push-button control. The tool is fed into the work on a cross-feed axis, and when the limit of safe travel is reached the driving motor is instantly stopped. This is accomplished by means of a



WHEN TOOL REACHES END OF TRAVEL THE MOTOR IS AUTOMATICALLY STOPPED

push-button contact made by a $\frac{9}{16}$-in. (14 mm.) iron rod attached to the base of the tool carriage. This rod, 18 in. (45 cm.) long, is provided with an adjustable set screw at the left-hand end which enables the operator to secure a close range of adjustment in automatic stopping. The rod is forged into a flat strip to facilitate attachment to the tool carriage base.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Plan to Interest Customer Stockholders in Company Affairs

THE Union Electric Light & Power Company of St. Louis has added a new section to its house organ, the *Wire and Pipe*, which is headed "Stockholders' Section." This publication, beginning with the January number, will be mailed to all stockholders for the purpose of informing them of the company's activities and financial condition and of acquainting them with the organization which carries on the company's work. From time to time communications of special interest to holders of stock will appear.

The January issue announces the sale of an additional million dollars of 7 per cent preferred stock ($2,000,000 is already outstanding), the sale of which was authorized by the Public Service Commission in January, 1918, but was not carried out owing to the Liberty loan campaigns of the government. The stock is now offered for the purpose originally authorized—namely, to pay for extensions to its lines, property and plant—at $100 per share for cash and $102 on the ten-payment plan.

Cost of Serving Small Customers with Lighting

THE cost of serving a small lighting customer is higher than many central stations operating in moderate-sized communities appreciate, and the following figures from a paper by Bowen Tufts, of C. D. Parker & Company, Boston, Mass., presented before the New England Section of the National Electric Light Association, are of considerable interest. Both companies mentioned are operated by the Parker interests, company A serving two small towns with a total population of 8,000, the connected lighting load being about 74 per cent of the total connected load. Company B serves five towns with a population of 18,000, the connected lighting load being 26 per cent of the total connected load.

COST PER YEAR PER CUSTOMER

	Company A	Company B
Reading and care of meters	$1.60	$1.64
Repairs to meters	.02	.03
Repairs to street lines and wires	1.49	1.11
Main high-tension lines (repairs)	.....	.37
Pole line rental	.28	.38
Clerk hire	.63	.85
Printing and stationery	.36	.43
Insurance	.47	.47
General office expense	.62	.71
Taxes on equipment for lighting customers	1.28	1.42
Tools and miscellaneous expense	.17	.15
Management charges	.17	.85
Rent of office	.10	.06
Legal expense	.16	.19
Stamp tax	.03	.02
Electricity purchased for lighting customers	7.56	4.55
	$14.94	$13.23
Depreciation at 5 per cent, prorated	4.22	6.82
Interest at 6 per cent on prorated investment and quick assets	6.85	9.85
Total	$26.10	$29.90

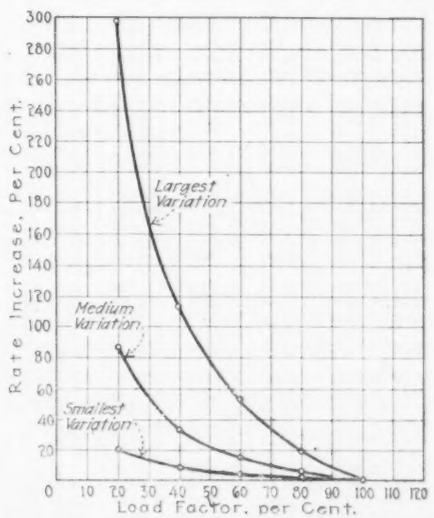
Mr. Tufts said that he believed that the minimum charge allowed in Massachusetts should be increased from $9 to $18 per year in view of the increased costs of material and labor, with future adjustments to meet changes occurring. If this could be done, it would immediately mean that electricity could be sold at a lower rate and thereby greatly increase its use, with a resulting tendency toward lower unit costs. The actual investment per customer is often from two to three times as large in thinly settled territories as in the cities. The average revenue per customer in the two cases cited was $1.80 and about $4 per month.

Energy Costs to Large Consumers of Power

A Study of the Rates Charged by Light and Power Companies to Customers Using Large Amounts of Electrical Energy

BY H. C. THUERK

THE present time appears to the writer to be an opportune one in which to consider the possibility of standardizing central-station rates, and it was with this ultimate consideration in view that some interesting information was collected from the rate schedules of several of the large electric light and power companies of America. A study was made of the various applications of load factor and power factor in the energy contracts of these companies, and data were compiled which present in concise form the prevailing



CURVES SHOWING RATE INCREASES OF COMPANIES HAVING LARGEST AND SMALLEST VARIATIONS AND MEDIAN RATE

practice of handling these factors in rate schedules. Such data should be considered in any problem of standardizing central-station rates.

Fifty-two companies were solicited for information on the subject outlined above, and replies were received from forty-four of them. The data contained in the communications from these companies form the basis for the observations and results given in what follows.

The annual load factors of the companies' plants show a variation from 32.5 per cent to 92.2 per cent, with a median value of about 52 per cent. The monthly load factors show a variation from 40 per cent to 92.8 per cent, with a median value of about 61 per cent. The power factors of the companies also vary considerably, depending somewhat on the time of day at which they are measured. The variation is from about 70 per cent to 100 per cent, with 90 per cent as a fair average value.

There seems to be little uniformity among the companies regarding the method or basis of determining the maximum demand of a consumer. The time interval over which the demand is taken varies from the instantaneous demand to a sixty-minute demand interval. In some cases a certain percentage of the connected load is taken as the maximum demand. The fifteen-minute demand is most generally used, with the thirty-minute demand next in importance from the standpoint of general usage.

Of thirty-seven companies which take load factor into consideration in their wholesale power rate schedules, twenty-five have the Hopkinson or demand and energy charge rate incorporated in them. This indicates that the prevailing method of handling the load-factor problem is by the use of the two-charge rate. Two of the companies use the three-charge or Doherty rate, while seven use the additive rate, which depends upon the number of hours' use of the maximum demand, together with a minimum-bill qualification. This rate differs little from the two-charge rate as regards complexity, but is much less equitable to the central-station company. The substitution of the latter rate for the less satisfactory minimum-bill schedule would result in a standardization of the rates which are most equitable to both consumer and operating company.

COST OF ENERGY TO CUSTOMER

Summary of the cost of energy per kilowatt-hour at different load factors for a specific load having a maximum demand of 1,000 kw.; also increase in rate for lower load factor using 100 per cent as basic price for energy

No. of Company	Cost per Kilowatt-Hour in Dollars					Rate Increase in Percentage			
	Load Factor					Load Factor			
	100	80	60	40	20	80	60	40	20
1	0.0171	0.0178	0.0190	0.0213	0.0284	4.1	11.1	24.6	866.1
2	0.0104	0.0108	0.0116	0.0132	0.0179	3.8	11.5	26.9	72.1
3	0.0245	0.0291	0.0368	0.0522	0.0976	18.8	50.2	113.0	298.0
4	0.0100	0.0107	0.0117	0.0139	0.0202	7.0	17.0	39.0	102.0
5	0.00638	0.00672	0.0073	0.00845	0.0119	5.3	14.4	32.4	86.5
6	0.0089	0.0095	0.0104	0.0123	0.0179	6.7	16.8	38.2	101.0
7	0.0125	0.0132	0.0142	0.0164	0.0227	5.6	13.6	31.2	81.5
8	0.0122	0.0140	0.0171	0.0230	0.0395	14.8	40.2	88.5	224.0
9	0.0118	0.0128	0.0144	0.0176	0.0272	8.5	22.0	49.2	130.7
10	0.0073	0.00865	0.0109	0.0132	0.0211	18.5	49.3	80.8	189.0
11	0.00725	0.00782	0.00875	0.0104	0.0148	7.9	20.7	43.5	104.0
12	0.0070	0.0075	0.0083	0.00997	0.0149	7.1	18.6	42.5	113.0
13	0.00703	0.0077	0.00888	0.0109	0.0169	9.5	26.3	55.0	141.8
14	0.0148	0.0156	0.0169	0.0197	0.0268	5.4	14.2	33.1	81.1
15	0.0100	0.0100	0.0100	0.0108	0.0188	0.0	0.0	8.0	88.0
16	0.0094	0.0098	0.0106	0.0122	0.0168	4.3	12.8	29.8	78.8
17	0.0056	0.00593	0.00650	0.00761	0.01096	5.9	16.1	35.9	95.7
18	0.00682	0.00685	0.00688	0.00694	0.00905	0.4	0.9	1.8	32.7
19	0.015	0.015	0.015	0.015	0.015	0.0	0.0	0.0	0.0
20	0.0081	0.00845	0.0090	0.0102	0.0137	4.3	11.1	25.9	69.2
21	0.0100	0.0100	0.0100	0.0108	0.0188	0.0	0.0	8.0	88.0
22	0.0084	0.0085	0.0087	0.0090	0.0100	1.2	3.6	7.1	19.1
23	0.0130	0.0138	0.0150	0.0175	0.0249	6.2	15.4	34.6	91.5
24	0.00709	0.00735	0.0078	0.0087	0.0111	3.7	11.1	22.7	42.3
25	0.0147	0.0149	0.0152	0.0158	0.0176	1.4	3.4	7.5	19.7
26	0.00709	0.00735	0.0078	0.0087	0.0111	3.7	11.1	22.7	42.3
27	0.00957	0.00995	0.0106	0.0119	0.0154	4.0	10.8	24.4	61.0
28	0.00509	0.0056	0.00648	0.00814	0.0127	10.0	27.3	59.9	149.2
29	0.00608	0.00635	0.00679	0.00768	0.0103	4.4	11.7	26.3	69.5
30	0.0058	0.0066	0.0080	0.0107	0.0190	13.8	37.9	84.5	228.0
31	0.0069	0.00725	0.0079	0.0091	0.0128	5.1	14.5	31.9	85.5
32	0.0098	0.0102	0.0109	0.0123	0.0165	4.1	11.2	25.5	68.4
33	0.0109	0.0116	0.0128	0.0151	0.0222	6.4	17.4	38.5	103.8
Median	0.00865	0.00908	0.0105	0.01205	0.01595	5.5	14.5	32.8	86.0

Only one company bases its maximum demand on kva. rather than kw. This appears to be theoretically the proper basis for determining the maximum demand of a consumer, since the output of a central station and its distribution system depends not on the kw. of the load it is supplying, but upon the kva. The difficulty of determining the kva. demand of a consumer has probably been responsible for the apparent unpopularity of this method.

In order to get some idea of the cost to the consumer of energy supplied by these companies, the accompanying table was prepared. This table gives a summary of the cost of energy per kilowatt-hour for each company at load factors varying from 20 per cent to 100 per cent for a specific load having a maximum demand of 1,000 kw. The median values of the cost of energy in cents per kilowatt-hour have been worked out from this table and are placed at the bottom of it. These values give a fair idea of the average price of energy as charged by the central-station companies of this country and Canada.

Using the cost per kilowatt-hour at 100 per cent load factor as the basic price for energy, the increase of the rate over this basic price for the lower load factors has been determined and placed in this table.

In order to obtain a rate increase curve which would represent most typically the practice of the operating companies, the medians of the values of rate increases were found and are given in the table. This median rate increase curve and the rate increase curves of the two companies having the greatest and least variations due to lowering of load factor have been plotted on the same set of co-ordinates and show vividly the variation in the present practice of handling load factor in energy contracts.

The companies are compared on the basis of the rate increase values rather than on the actual cost of the energy because of the fact that the latter is governed almost entirely by local conditions. Items such as the price of coal, labor and supplies, distance of central stations to consumers and the nature of the lighting and power loads of the companies make a comparison on any other basis unjustifiable.

From the table and the curves it is apparent that for the particular load conditions assumed there is a very very wide variation in the rate increases of the companies. This variation is dependent to a great extent upon the ratio of the fixed charges to the operating expenses of any one company. The larger this ratio, the smaller will be the rate increase for the lower load factors, since in this case the demand charge forms a larger part and the energy charge a smaller part of the total cost of the energy than when the ratio is small.

Dependability of Electric Meters

AT A RECENT gathering of the California State Association of Electrical Contractors and Dealers in Sacramento some interesting statistics as to the dependability of electrical service meters were presented by Charles G. Johnson, State Superintendent of Weights and Measures for California. Of 80,703 meters inspected in London in 1917, said Mr. Johnson, 78,739 were found correct. Out of 86,025 inspected in Edinburgh, only 770 were found in error. Out of 29,154 inspected in Canada in 1908, 58 were in erro.. In that

same year, in New York, out of the total of 103,236 meters inspected, there were 2,045 fast and 1,675 slow. In Massachusetts in 1908 it was found that 99.8 per cent of the 58,678 meters inspected were correct.

"Evidence such as this," commented Mr. Johnson, "could be multiplied indefinitely to prove that the vast majority of meters in use today were correct when they were put into service, and while in the case of meters concerning which complaint has been made the proportion of fast ones is naturally greater than is the case with other meters, the average error of such meters, if taken over a considerable period of time, will rarely exceed 5.5 per cent. The burden of evidence seems to prove conclusively that the public service company loses vastly more by its slow meters than it gains by those that are fast."

Profit Making Not Always Profiteering

Central Stations as Well as Manufacturers Are Entitled to a Profit When Their Product Is Made and Marketed Economically

BY "KASSANDRA"

PUBLIC utilities have suffered in the past from the indiscriminate use of the words "trust" and "corporation" in an invidious sense, and, as pointed out in a recent publication, it behooves us not to make others suffer from the same kind of error. "Profiteering," for instance, is a horrid word; but let us inquire as to how profits arise and as to what makes profiteering. Profit, of course, is the difference between cost and sale price. Cost, however, is used with many meanings. "Cost" sometimes means the bare cost of the raw material, at other times the cost of the raw material plus labor. In still other cases interest on borrowed money is included in cost but not any return on the rest of the investment. However, it is clear that for our purposes cost should include all these items, provided that the return on the investment is a reasonable one. An unreasonable return may be obtained in either of two ways—first, by getting the cost down; second, by putting the price up.

Is profiteering by getting the cost down in any way reprehensible? Is it wrong to make profits by reducing costs? If a manufacturer or distributer sells the goods at the lowest price for which any one else will sell goods of the same quality, is any percentage of profit immoral or wrong in any way? Should not such a manufacturer or distributer be allowed and encouraged to make 100 per cent or more on his investment, so long as he sells the goods at prices as low as those of his competitor? Why should he not be entitled to the whole saving that he has made? No matter what he does with it at first, the public in the end gets some advantage from his savings.

If, on the other hand, a man who sells at the lowest price is punished in any way or discouraged by an excess-profit tax or a supertax, he suffers and in the end the public also suffers. It is clear that the making of profits by reducing costs is not wrong, but how about profits made by raising the price? *i.e.*, suppose the manufacturer doesn't make any savings but just raises prices. Now, whether this is profiteering or not would seem to depend on whether people are obliged to buy of him rather than of his competitor. If they don't buy, then he makes no profit. If, however, people do buy, why is it they buy of him rather than of any one else? Is it not the case that this manufacturer supplies a quality of service which is worth more to the purchaser than they can get elsewhere? It may be said that all the manufacturers might get together and all charge $11 for shoes which cost only $10, but this points to the conclusion that there is never any profiteering (that iniquitous profiteering) on the part of independent manufacturers but that profiteering exists only as the result of a trade combination or monopoly. However, most businesses are open to all. Suppose the hundred or thousand or ten thousand shoe manufacturers should all get together and start to profiteer. Why can't the trunk makers and harness makers start in to make shoes? They can in a short time make shoes at as low cost as the others because they have or can get fairly easily the necessary leather and labor and plant. If, however, they refuse to do it, who is the iniquitous profiteer? On the one hand, we have the shoe manufacturer who will sell the public shoes for $11. On the other hand, we have the rest of the leather people who could make shoes for $10 but who refuse to make them at any price—or perhaps the trunk maker says, "All right, I'll make a thousand pairs of shoes if you will pay me $15 a pair."

Some people have made profits during the war, but are we not glad that they did the work? If the profiteers had foreseen a penalty for profiteering, would they not have said: "We had better sit tight and do the way the rest of the people do; then we won't be committing the crime of profiteering." And how would we have won the war?

We were mighty glad to get people to work. Is not the man who worked and made a profit deserving of more credit than the man who didn't work? Of course, the man who worked and gave his service and perhaps his life for the country without any reward at all is the man who deserves the most credit, but he deserves his credit for the work he did and not for the profit he refused to take.

Let us put these in the following order: First, the soldier who gave his life or the citizen who gave his property without return; next, the men who did the work cheaper than any other would do it at the time and made the maximum of profit by economy and skill in manufacture; next, the less skillful manufacturer who did the work and covered the costs and a return on the investment but made no profit. The men last named did less for the country than the men who made profits which now add to the total wealth of the country. Finally, lowest of all, are the men who sat tight and did nothing but tried to discourage profits and economies by threatening that they would "get" the profiteers.

Investigation always shows that the so-called profiteers (outside of a few illegal monopolies) have made their money by economies in manufacturing distribution and that at the time they sold their goods they were selling them at or below the price at which any one would then sell goods of equal quality. If a central station can keep its prices down to what the normal central-station operator can do, and can then make savings in addition by care and skill, is it for the public advantage that it should be accused of profiteering, or should it be encouraged by being allowed to pay high dividends and to attract more money to the business?

Digest of Electrical Literature

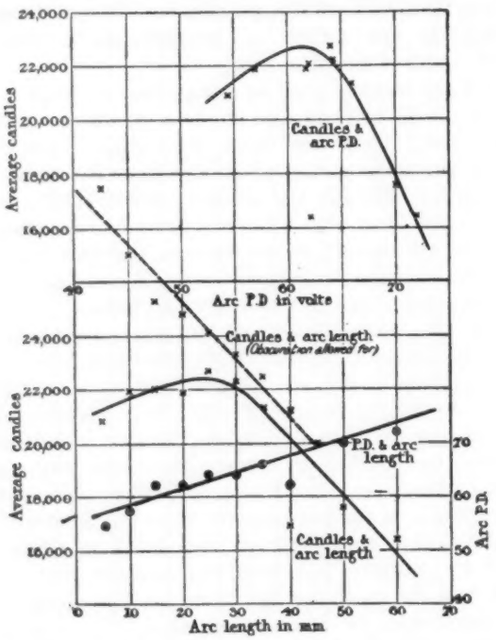
Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Recent Progress in Armature Design.—WOLFF—This article forms a review of a great number of recent patents relating to details of armature winding. Descriptions are given of various arrangements for cutting down eddy-current losses in heavy conductors by splitting the copper in several parallel bars, which are insulated from each other and systematically transposed.—*Helios*, March 30, April 6 and 13, 1919.

Lamps and Lighting

Carbon Arcs for Searchlights.—C. G. PATTERSON, J. W. T. WALSH, A. K. TAYLOR and W. BARNETT.—The object of the investigations as stated by the authors was (a) to develop the best method of testing carbons in order to prove their value for searchlights, (b) to compare the relative qualities of existing carbons other than flame carbons for producing high-intensity searchlight beams, (c) to determine what improvements can be made either in the carbons themselves or in the methods of burning them. As shown in the illustration, the potential difference and the arc lengths increase or



VARIATION OF CANDLEPOWER WITH VOLTAGE AND ARC LENGTHS

diminish together, but a large change in these quantities did not affect the average candlepower. In order to obtain under working conditions a given amount of light from a given positive carbon, it is necessary to pass through it a given current, the voltage across the arc and the arc length required to avoid hissing being immaterial. A positive carbon taking 200 amp. at 70 volts—i.e., 14 kw.—will emit the same light as one taking 200 amp. at 100 volts, or 20 kw. From the point of view of light emission from the positive crater, the extra 6 kw. is wasted. In order to insure, however, that all but a very small proportion of the light directed toward the mirror from the positive carbon misses the negative, it is necessary for the arc length to exceed a certain minimum figure and to obtain carbons which will take the maximum current through the positive crater at this minimum arc length, thus securing all the light possible with the minimum amount of dissipation of heat at the arm.—London *Electrician*, Dec. 5, 1919.

Report of the Committee on Progress, Illuminating Engineering Society.—This is a very complete report on the progress made in illumination during the past year. The report can best be described by briefly enumerating the subjects taken up as follows: Gas, electric incandescent lamps, arc lamps, lamps for projection purposes, influence of the war, street lighting, other exterior illumination, interior illumination, fixtures, photometry, physics, legislation, physiology, illuminating engineering and books. The report was prepared by the committee under the chairmanship of Francis E. Cady.—*Transactions I. E. S.*, Nov. 20, 1919.

Renewed Lamps.—A process which is said to be due to F. Harrison for the renewal of burned-out metal-filament lamps is described in considerable detail. This process is now in commercial use in a London factory.—London *Electrician*, Dec. 26, 1919.

Home Lighting—How to Make It Comfortable and Effective.—A. L. POWELL and R. E. HARRINGTON.—Attention is called to the considerations which enter into the design of an illuminating system for the home. The light must be comfortable and without glare. The fixtures should be artistic and harmonize with the surroundings. Color effects may also be readily obtained at a reasonable cost. Each room in the home is then taken up and suggestions made for its adequate and proper illumination.—*Transactions I. E. S.*, Nov. 10, 1919.

Generation, Transmission and Distribution

Selecting a Switchboard for a Plant of Moderate Size.—G. E. WENDLE.—It is shown how a 30,000-kw. central station came to select a truck type of switchboard, and an analysis of the local conditions and description of the equipment are given.—*Electrical Review*, Dec. 20, 1919.

Hydro-Electric Power Collection.—CHARLES P. STEINMETZ.—The author discusses a future power development in which very simple generators are located at many small hydraulic power sources. These pump power to central stations, where it is controlled and fed into power line. This paper amplifies former articles on the subject by Dr. Steinmetz.—*General Electric Review*, November, 1919.

Induction Generator Plants.—C. M. RIPLEY.—In some instances, and under specially favorable circumstances, the induction-generator plant with little or no attendance may be justified. The author presents a brief

description of such of these as have been in operation for a sufficient time to demonstrate their practicability. If the prices of coal and labor continue to rise, it is possible that the small induction-generator plant may soon be economically more feasible than it is at the present time. The table gives data concerning the number of plants in practical operation that were too small to be profitably developed as synchronous generating plants.

Name of Plant	Kilowatt-Hours Per Year	Head-Feet
Pacific Power & Light Company, drop plant (1,400 k.w.)	6,000,000	50
San Joaquin Light & Power Corporation, Crane Valley Plant (1,000 kva.)	3,500,000	80-120
San Joaquin Light & Power Corporation, Reservoir 1-A plant (425 kva.)	3,000,000	39
Greenfield Electric Light & Power Company, Green River plant (100 hp.)	250,000	8½ - 11½
Taylor Wharton Iron & Steel Company	150,000	14
Total	12,900,000	

—*General Electric Review*, November, 1919.

Preventing Versus Correcting Poor Power Factor.—H. GOODWIN, Jr.—The author advocates considering every detail in connection with poor power factor as worthy of attention. By carefully testing motors and keeping the records it is possible to prevent over-motoring, which is the chief cause of low power factor.—*General Electric Review*, November, 1919.

Peat for Electric Generating Plants.—E. PHILIPPI.—The great importance of peat for the future coal-saving program of Germany is emphasized. The author estimates that the peat reserves in Germany represent an energy of 1,790,000,000,000 kw.-hr., or a supply of 2,050,000 kw. uninterruptedly for 100 years if utilized in large steam plants.—*Elektrotechnische Zeitschrift*, Aug. 28, 1919.

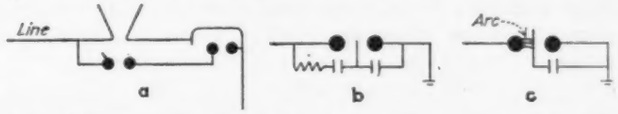
Limitations of High-Voltage Transmission—T. A. WORCESTER.—In dealing briefly with the developments of higher voltages for transmission purposes the author shows this growth by means of the accompanying table.

INCREASE IN TRANSMISSION VOLTAGES

Year	Maximum Voltage	Year	Maximum Voltage
1894	11,400	1907	104,000
1896	22,000	1909	140,000
1900	54,000	1912	150,000
1901	80,000		

He says that at the present time there are about fifty companies operating at 70,000 volts or above and that their systems aggregate some 14,000 miles (22,500 km.) of single-circuit line on which over 2,000,000 suspension insulator disks are used and to which over 2,000,000 kw. in generating capacity is connected. One of the chief difficulties to be dealt with in the use of extra high voltage is the supply of the required charging kva. from one generator when the line is run at light load. The charging kva. of a 200-mile (320-km.) 60-cycle line operating the 220,000 volts at the generating end would be approximately 50,000 kva. Making use of the standard type of any suspension disks, it will be necessary to use twelve or fourteen units for the 220,000-volt lines. In this case it is necessary to reduce the voltage stress over the insulated disk next to the line. Various schemes of grading have been suggested, and the prospects are good that some practical arrangement of this sort will be worked out in a short time. Regarding the expense of insulating the lines for the extra-high-voltage transmission, this is not difficult from the point of view of the expense, since the extra high voltage is only economical when large amounts of power are involved. To illustrate, a 250-mile (400-km.), 110,000-volt line for 10,000 kw. cost $2,500,000, whereas a line of the same length operating at 220,000 volts with 100,000 kw. capacity would cost $7,500,000, an increase in output of ten to one with an increase in cost of three to one. In one case the line investment is $250 per kilowatt and in the other $75 per kilowatt.—*General Electric Review*, November, 1919.

Lightning.—F. W. PEEK, JR.—This is the second article on the subject by the author and takes up the effect of lightning voltages on arrester gaps, insulators and bushings on transmission lines. The author calls attention to the necessity of producing lightning arresters of very high speed if steep wave-front impulses are to be removed before damage is done to apparatus. A number of interesting gap combinations are shown. Two sphere gaps used in *a*, one of which is covered and



the other exposed to the weather. These gaps are balanced to break down simultaneously, and the spark of the outside one is transferred into the horn when it rises and breaks. In *b* is shown a selective scheme whereby the voltage distribution depends upon the frequency. For steep wave fronts the resistance has the effect of opening the circuit on that side. The gap on that side breaks down, as at *c*. The spark-over voltage thus changes with the steepness of wave front.—*General Electric Review*, November, 1919.

Equipment of Spanish Hydro-Electric Power Systems.—A description of the hydro-electric plants and transmission system of the Sociedad Hidroelectricà Espanola, which is the second largest development in Spain, its production in 1917 amounting to 143,000,000 kw.-hr.—*Southwestern Electrician*, December, 1919.

What the Adoption of Higher Steam Pressures Will Mean.—F. R. PARSONS.—The writer considers the effect of higher steam pressures on standard boiler design, on the materials used and on reciprocating engines. He states that in connection with reciprocating engines the use of increased superheat corresponding to pressures of 500 lb. (35 kg. per sq.cm.) or so would make more difficulty than the higher pressure.—London *Electrician*, Jan. 2, 1920.

Traction

Electric Locomotives for Industrial Purposes.—KENNETH ANDREW and WALTER FIXTER.—A general description of the advantages and adaptability of the storage-battery trolley and combination storage-battery and trolley types of locomotives.—*Journal Engineers' Club of Philadelphia*, January, 1920.

Installations, Systems and Appliances

Modern Electric Furnace Practice as Related to Foundries in Particular.—W. E. MOORE.—It is said that since 1913 the number of electric furnaces employed in the steel industry in the United States and Canada has risen from 19 to 335, practically all of which are of the arc type. After giving particulars regarding the operation of acid and basic furnaces, the author enumerates the superior properties which have created the present demand for electric steel. He points out the advantages of the electric furnace over the open-hearth furnaces in steel melting and states the features of the various

classes of arc furnaces which have made that type so commonly employed in the field. The crucible and converter processes are briefly described, and it is shown how the acid type of furnace is the best for foundry work. Comparative operating costs of producing liquid steel by the converter and electric furnace processes are then given, which bring out the marked economy of the latter. The paper concludes with notes on the employment of the electric furnace in malleable-iron foundries and on the selection of the most suitable type of furnace for a given installation.—*Paper presented at the meeting of the American Society of Mechanical Engineers*, Dec. 5, 1919.

Electric Propulsion of Merchant Ships.—W. R. EMMET.—The author states that improvements in electrical designs have been developed which have led him to the belief that electric drive is justified in all large ships and that it will very soon develop a wide application. With the operating experience now available as a result of the electric drive on warships, the writer points out in detail the advantages of electric drives in the matter of efficiency, economy, reliability, etc.—*Paper presented at meeting of the Society of Architects and Marine Engineers*, Nov. 14, 1919.

Electricity in Tin Mining.—D. M. W. HUTCHISON and W. J. WAYTE.—This paper is based on experience by the authors in tin mining in the Federated Malay States. It contains extensive tables showing the power required for various operations and the cost of electrical energy to perform this work.—London *Electrician*, Dec. 26, 1919.

Electrophysics and Magnetism

Criteria for the Testing of Magnetic Materials.—The writer divides the necessary tests into two parts, (a) the tests on materials and (b) the tests on products. He then applies tests which are directly related to his requirements. In a material test the material only is involved, but in the product test there are involved conditions due to the design and the manufacture as well as those due to the material.—London *Electrician*, Jan. 2, 1920.

Magnetic and Mechanical Testing of Iron.—It is pointed out that many mechanical defects in iron used for various purposes can best be detected by the magnetic properties.—London *Engineering*, Nov. 28, 1919.

Units, Measurements and Instruments

Testing Transformers by the Alternating-Current Potentiometer.—DOUGLAS C. GALL.—In testing instrument transformers it is pointed out that it is difficult to measure alternating voltages to 0.001 volt with a voltmeter. With the alternating-current potentiometer the writer states that only three readings are necessary for the determination of phase displacement and ratio of transformation. The three readings of voltage are self-checking, inasmuch as they form three sides of a triangle which should close.—London *Electrician*, Nov. 28, 1919.

Telegraphy, Telephony and Signals

Telephonic Transmission of Superimposed Circuits.—KAZUKIGO OGANA.—In this article is contained a mathematical discussion of the possibility of increasing traffic facilities by superimposing on two existing telephone lines a standard circuit. In one case under discussion repeating coils are used at both ends of the line where the phantom circuit is attached. The other system under consideration makes use of retardation coils to the middle points of which are connected the phantom lines. —*Research Bulletin Number Seventy-eight, Department of Communications*, Tokio, Japan.

The Fessenden "Pelorus" (Wireless Compass).—REGINALD A. FESSENDEN.—The present article gives a brief description of the various types of the Fessenden "pelorus," indicating the causes of the erroneous readings which have been obtained and describing the methods which must be used to obtain accurate results. —London *Electrician*, Dec. 19, 1919.

Vacuum-Tube Amplifiers.—W. SCHOTTKY.—The author claims to have been one of the first Germans to take up the study of vacuum-tube amplifiers from an engineering standpoint, and in this paper he gives an outline of the results of his studies. In the first part of the article the functions of the input transformer are discussed, and analytical expressions are derived which define the conditions of optimum amplification when adapting a given tube to a certain amplifier problem. The second part deals with the predetermination of the tube constants from certain constructional data of the tube. The problem is reduced to a unit-dimensional one by introducing the so-called "effective potential in the grid plane" as a single variable. Expressed in terms of the plate potential and the potential values on the control elements, this "effective potential" is a linear function whose coefficients depend only upon the design of the tube and the electrodes. It is shown that the optimal amplification of a cylindrical tube with one grid is proportional to the square root of the plate battery voltage and to the square root of the length of filament and grid, and inversely proportional to the square root of the distance from filament to grid. The theory is checked by measurements on a Siemens-Halske tube of given design.—*Archiv für Elektrotechnik*, May 5, 1919.

Miscellaneous

The German Aluminum Industry.—Upon incentive from the German Department of War Materials a number of big aluminum works were erected during the war, the electric energy being supplied over a system of 100-kv. transmission lines connecting the large steam plants in the lignite districts with the respective works. In a recent book by Tröger the future of this war industry is discussed. The German production is estimated at 40,000 tons a year as compared with 73,000 in the United States and Canada and 80,000 in other European states. Tröger finds that the cost of production will be 0.51 mark per kilogram higher in Germany than in other countries and that the price ratio of aluminum to copper will be 1.60. The latter figure shows that aluminum will be unable to compete with copper for conductors since the weight ratio of corresponding conductors is as 1:1.5. It is therefore proposed to equalize, by artificial means under control of the government, the price of German-produced aluminum with that of the imported ware, and also to keep the price ratio of aluminum and copper equal to 1.50.—*Elektrotechnische Zeitschrift*, Sept. 11, 1919.

The Human Body as a Conductor of Electricity.—M. GILDEMEISTER.—Extensive investigations, including resistance measurements with direct and alternating current, have led the author to the conclusion that the high direct-current resistance and the leading phase angle observed in alternating-current measurements are due to the electrolytic polarization of the skin. *Elektrotechnische Zeitschrift*, Sept. 18, 1919.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available. and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Methods of Electrolysis Survey and Experiment

A STUDY is being made of improvements possible in the methods of carrying out the surveys leading up to work in mitigation of electrolytic corrosion, and particular attention is being given to the methods of measuring the current flowing in pipes and the leakage of current from pipes, to replace the old method of measuring differences in voltage between the metal structures concerned. A number of instruments have been built, and, having given satisfactory results in laboratory tests, they will shortly be tried out under field conditions. Because of the contradictory character of the evidence as to the conditions under which corrosion of lead cable sheaths occurs, it has been necessary to carry on a great deal of laboratory work, as, for example, to determine the variation of corrosion with varying current densities in earth, sand and water. In agreement with previous results, it has been found that the corrosion per unit of current is greater when the actual current density is small. Experiments have been carried on to simulate the condition which occurs when parts of a piping system are alternately positive and negative so that at times the current flows into and at other times out of the metal. The relative amount of corrosion has been found to decrease very rapidly when the portion of time during which the specimens are positive is decreased, and it appears probable that in such cases some of the metal is actually re-deposited on the specimen when the current is reversed, although it has not yet been possible to prove this conclusively.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

ALUMINUM ALLOYS, MECHANICAL PROPERTIES AND RESISTANCE TO CORROSION OF.

Light aluminum alloys of several compositions belonging to each of the three ternary series, aluminum-magnesium-copper, aluminum-magnesium-manganese and aluminum-magnesium-nickel, were rolled out into sheet and tested in tension as cold-rolled, after annealing, and after heat treatment, consisting of quenching from about 500 deg. C. and aging at ordinary temperature. The alloys of the aluminum-magnesium-copper series were superior in all conditions to those of the other series, in respect to tensile properties. The tensile properties of the aluminum-magnesium-copper series may be much improved by appropriate heat treatment. The alloys of the aluminum-magnesium-nickel series are also improved by heat treatment, but not in the same degree as the former series. The alloys of the aluminum-magnesium-manganese series are not improved by heat treatment. Samples of representative compositions of each series were exposed to corrosion in the salt spray test, and the appearance of the samples observed after one and after two months' exposure to the action of the salt spray. The alloys of the aluminum-magnesium-manganese series resisted corrosion in general better than those of the other series, and this agrees with other experience in the corrosion of such alloys. The heat-treated specimens of the aluminum-magnesium-copper series were, however, but little inferior to those of the manganese series in their resistance to corrosion. The annealed and the cold-rolled samples of that series were the least resistant to corrosion of any of the alloys tested. Hard-rolled commercial aluminum corroded much more than any of the alloys. Annealed aluminum was more resistant to corrosion than the hard-rolled aluminum but did not compare favorably with most of the alloys.—*P. D. Merica, R. G. Waltenberg and A. N. Finn, Bureau of Standards, Washington, D. C.*

CABLES, DIELECTRIC LOSSES IN.

There has been considerable discussion during the past two years on the subject of dielectric losses in underground cables. Very little real progress appears to have been made, although several large cable users are planning to incorporate in their cable specifications a clause relating to dielectric losses. The committee has been advised that cable manufacturers have been working on this prbolem with a view to standardizing equipment and methods of measurements, and it is recommended that succeeding committees give this matter their attention.—*A. I. E. E. Committee on Transmission and Distribution.*

FURNACE, ELECTRIC, FOR THERMAL ANALYSIS.

Rosenhain in 1915 published a description of a furnace for the thermal analysis of metals, operating on a new principle. Instead of varying the temperature of the furnace containing the specimen under investigation, he heated the furnace so as to produce a uniform temperature gradient along its length and moved the specimen through the furnace. Some improvements have been made in the design of this furnace, and a simple method of mounting has been devised which gives highly satisfactory results using specimens of less than 2 grams weight.—*H. Scott and J. R. Freeman, Jr., Bureau of Standards, Washington, D. C.*

GLASS, THERMAL EXPANSIVITY OF.

At the request of the War Industries Board the thermal expansivity of some optical glass was determined for use in naval searchlight mirrors. The decision as to whether or not the glass was suitable rested exclusively upon its thermal expansivity. With the stretched wire dilatometer constructed for the purpose expansions were measured up to 300 deg.—*A. W. Gray, Milford, Del.*

INSULATING MATERIALS, LAMINATED PHENOL TYPE.

In order to determine how an electric apparatus will behave in service, it is important to know how the insulating materials upon which the conducting parts are mounted will be affected by the electrical conditions involved. The permanence, strength and numerous other mechanical and electrical properties, such as the effects of moisture, the amount of power loss in the material, etc., are all factors of importance in determining the suitability of insulating material for a given service. Extensive investigations have been made during the war, and the results of the work have been such as to point the way to improvements in methods of manufacture and quality of products. A publication now in preparation by the bureau is entitled "Properties of Insulating Materials of the Laminated Phenol Type." In this work the bureau has had the cordial coöperation of the manufacturers of this class of materials and the navy and Signal Corps.—*Bureau of Standards, Washington, D. C.*

PHOTOMETRY, PHOTOELECTRIC, BY THE NULL METHOD.

In connection with the color standardization work of the National Bureau of Standards, it is desired to have available a number of independent methods of making spectrophotometric determinations, especially in the visible part of the spectrum; for it is generally admitted that the fundamental basis of color specification is spectrophotometry. To supplement the other methods at present in use at the bureau, and especially to overcome the well-known uncertainty of measurements by these other methods in the blue and violet, a method has been developed for accurate and convenient photoelectric spectrophotometry, suitable for routine determinations. The null method is used, and two photoelectric cells and the proper batteries are connected in a sort of Wheatstone bridge arrangement, with the electrometer as the indicator. Radiant energy from a 600-watt gas-filled incandescent moving-picture lamp, after dispersion through a Hilger constant deviation spectrometer, is incident upon one of the photoelectric cells. Radiant energy from a 14-watt gas-filled lamp is incident on the other photoelectric cell. The photoelectric currents generated in the two cells by the radiant energy from the two lamps tend to nullify each other so far as charging the electrometer is concerned, and by proper adjustments the two currents may be made exactly equal.—*K. S. Gibson, Bureau of Standards, Washington, D. C.*

[This is in line with the modern endeavor to do away with dependence upon the human eye in photometry.—EDITOR.]

RUBBER, DIRECT DETERMINATION OF INDIA RUBBER BY NITROSITE METHOD.

The method of determination of india rubber described by Wesson was applicable only to compounds containing new rubber, and even for these was not always satisfactory. By suitably varying the procedure it has been found possible to extend the usefulness of the method to compounds containing reclaimed rubber and substitutes, as well as lamp-black and bituminous substances. The method is based upon the formation of rubber nitrosite, which is purified and burned in a combustion furnace, and the carbon dioxide formed is calculated to rubber.—*John B. Tuttle and Louis Yurow, Bureau of Standards, Washington, D. C.*

SOUND, A STANDARD OF.

A simple appartus has been constructed and tested which bids fair to furnish a standard of sound of any desired pitch and particularly free from overtones. The apparatus consists essentially of a trap made of pure glass, similar to a trap used with a mercury-vapor pump. The air may be heated with a Bunsen burner. By supplying heat electrically at a constant rate the pitch may be kept constant for an indefinite length of time.—*Charles T. Knipp, University of Illinois, Urbana.*

STEEL, ELECTROLYTIC RESISTANCE METHOD FOR DETERMINING CARBON IN.

Method and apparatus have been devised for rapidly and accurately determining carbon in steel by absorbing in a solution of barium hydroxide the carbon dioxide resulting from direct combustion of the metal in oxygen and deducing the carbon content from the change in electrical resistance of the barium hydroxide solution.—*J. R. Cain and L. C. Maxwell, Bureau of Standards, Washington, D. C.*

STEEL—LOCATION OF FLAWS IN RIFLE BARRELS BY MAGNETIC ANALYSIS.

This investigation was undertaken for the purpose of determining whether an application of magnetic analysis was practicable for the detection of flaws in rifle-barrel steel. By means of apparatus especially constructed for the purpose a large number of bars were explored for magnetic uniformity along their length. In spite of the fact that these bars were taken from material which had previously been rejected as the result of drilling tests, not one was found which contained a pipe. The results obtained, however, demonstrated that the method is amply sensitive to detect and locate flaws. Further study is necessary to determine to what degree the sensitivity of the apparatus should be reduced in order not to cause the rejection of material which is satisfactory for all practical purposes and also to determine the type and magnitude of the effect which will be produced by a pipe. For this reason the work is being continued by the Winchester Repeating Arms Company, which coöperated in the investigation and at whose plant the apparatus has been installed.—*R. L. Sanford and W. B. Kouwenhoven, Bureau of Standards, Washington, D. C.*

SUBMARINE RADIO.

Experiments were made by the bureau in co-operation with the Navy Department to determine the possibility of communication under water. Using a coil aerial instead of an antenna it was found entirely feasible to communicate with the submarine and all parts of the equipment entirely submerged. The coil used was a single turn of wire attached on the outside of the submarine. The coil has a number of advantages over the antenna for submarine uses. The wave length of an antenna circuit changes while the submarine is submerged, and the antenna does not function at all when completely submerged. The coil circuit, however, does not change in wave length during or after submergence. The depth of submergence possible increases with wave length. Using this simple device, signals transmitted from the other side of the Atlantic were easily received when the submarine was submerged. Transmission experiments were not carried very far, but it was established that the coil could also be used for transmission over a distance of 15 km. It thus becomes possible for a ship and a submerged submarine to exchange recognition signals, which is a most important advance in the functioning of submarines. The coil aërial is a satisfactory direction finder when submerged, just the same as when used in air.—*Radio Laboratory, U. S. Bureau of Standards.*

TIN, CONSERVATION OF, IN BEARING METALS, BRONZES, AND SOLDERS.

An investigation has been made regarding the possibilities of conservation of tin in bearing metals, bronzes and solders—much of the data having been obtained from questionnaires sent to representative manufacturers and users of the above-named alloys. Tables have been compiled showing the chemical composition and physical properties of many of the suggested alloys and also for service tests of genuine babbitt and a high-lead bearing metal. Tentative recommendations for standard grades of bearing metal are also included. Proper solders for various industrial uses can be recommended, and a new solder has been developed consisting of a preponderance of lead with small amounts of tin and cadmium.—*G. K. Burgess and R. W. Woodward, Bureau of Standards, Washington, D. C.*

VARNISHES, INSULATING, ELECTRICAL CHARACTERISTICS OF.

An investigation is in progress with the object in view of determining the electrical characteristics of high-temperature varnishes and shellacs now on the market, especially their dielectric strength and losses. An attempt will be made to produce a super-varnish that will retain its physical properties and electrical strength for temperatures up to 600 deg. At the same time the effect of heat on dielectric losses will be investigated.—*H. Logan, New York City.*

WELDING, ARC, AUTOMATIC MACHINES.

The skill of the operator or the human element is still the most vital factor in producing uniform high-grade joints. We have to depend upon the operator in maintaining the constant length of arc and upon his judgment in determining the most desirable current adjustment with the variable conditions of the work on hand. Automatic self-feeding welding machines have been recently designed and are being experimented with. Much usful research and development can be done along these lines.

WOOD AS INSULATOR.

We have abstracted moisture from wood by the dry-kiln process, which is rather slow but not particularly expensive, and which, although reasonably effective, will not take out the last particle of moisture. A more effective process is to heat the wood in a steam-jacketed vacuum tank from which the moisture as it evaporates is continually pumped out and condensed. This method will probably take out more moisture than any other, but is quite slow and expensive on account of the expensive apparatus required, the cost of attendance and the other operating items in connection with operating a steam plant for heating and a vacuum pump. Apparently the reason for the slowness of this process is that when the sticks of wood are in the vacuum tank there is only a very slow transfer of the heat from the steam jacket through the vacuum to the wood. The insulating compound is ordinarily injected into the wood by placing the pieces to be treated in a tank to which the melted insulation is admitted and sucking the air out of the pores of the wood by means of a vacuum pump until no more air can be pumped out. The vacuum is then released and pressure put on the tank, which forces the insulating compound into the wood. The difficulty in carrying on this process consists in determining how much pressure should be applied and for how long a time in order to impregnate wood of various kinds to various depths.—*H. H. Cochrane, Butte, Mont.*

Suggestions for Research

CABLES, TEMPERATURE MEASUREMENT IN.

The A. I. E. E. Standardization Rules prescribe a certain upper temperature limit for cables, but there seems to be no practical method available at present for actually measuring the core temperature of a high-tension cable in operation. A research into the possibilities of direct or indirect determination of this temperature will be of great value to the industry. This point was brought out at the last A. I. E. E. convention.—*Editorial Suggestion.*

FURNACE, ELECTRIC, POWER-LIMITING DEVICE.

Some steel plants purchase electric energy for furnace operation from power transmission or distributing companies on a maximum-demand basis. Sometimes a peak load comes simultaneously on several furnaces, thus unnecessarily increasing the monthly bill. A device is desired which not only would warn of the approach of the desired maximum demand but would automatically cut down the load on one or more furnaces at will, not allowing the total load to exceed the agreed value. Reactance coils connected into the main circuit in sections by means of automatic contactor switches are not recommended because the power factor is low as it is, and the tendency is to penalize the customer for it.—*Editorial Suggestion.*

INSTRUMENTS FOR AEROPLANES.

Two instruments which it would be very desirable to have on an aeroplane would be one giving the speed of the plane relative to the ground (not relative to the air) and one showing the altitude of the plane above the ground. Pilots flying at night with a barograph know only their altitude above sea level, and as they may not know the character of the ground over which they are flying, when they fly at low elevations (1,000 ft. to 2,000 ft. [300 m. to 600 m.] above sea level), they are not at all certain that they are at a safe altitude.—*E. H. Sherbondy, Bureau of Aircraft Production, Washington, D. C.*

INSULATORS, HIGH TENSION.

Progress in the design of high-tension insulators must provide for (1) reduction of porosity to the lowest possible limit, (2) joints designed to avoid cracking from expansion and contraction, and (3) ample mechanical strength.—*A. I. E. E. Committee on Transmission and Distribution.*

LIGHTNING ARRESTERS AT HIGH ALTITUDES.

The question of flashover ratings at high altitudes is steadily becoming of greater importance. In the past lightning-arrester spark gaps in the Colorado district and other similar high places have required settings far beyond those indicated by the change in air density, temperature, etc. It is possible that other factors such as waves of short length in the sunlight, ionization by mineral deposits, etc., have an effect. College students, instructors and engineers in the West who have the opportunity of working at high altitudes, say along transmission lines, could do some valuable work in testing flashovers, calibrating sphere gaps, etc., under varying conditions of altitude, humidity, sunlight, etc.—*L. W. Chubb, Pittsburgh, Pa.*

MOTOR, INDUCTION TYPE, REACTIVE STARTER FOR.

A three-phase choke oil with a *solid* iron core is permanently connected to the slip rings of the rotor. The motor is started and reversed by applying the full voltage to the stator. At high values of slip the choke coil acts as a starting resistance, owing to heavy eddy currents. At full speed the effect of the choke coil is small. The motor may be quickly reversed at full speed, the choke coil acting as a brake. It is used in some heavy-duty drives in England, for example, in steel mills, but is very ittle known in this country. With a decided tendency towards alternating-current drives in steel mills, this simple method of control deserves serious attention.—*Editorial Suggestion.*

RADIO TRANSMISSION.

A number of research problems in radio transmission and reception that await solution will be found at the end of an article on the subject by Dr. J. H. Dellinger of the Bureau of Standards, *A. I. E. E. Proceedings.* October 1919, page 1147. Theoretical as well as experimental problems are mentioned, and the subjects include wire antennas, coil aerials and condenser aerials.

SWITCHES, DISCONNECTINC.

A case has been reported of a severe short circuit in a large hydro-electric plant, when the locking latches on some disconnecting switches were sheared off and even the supporting insulators were torn asunder by the magnetic forces and by the resulting arc and explosion. This suggests the possibility of holding the blade in place by a tension spring instead of a latch. The spring will yield, allowing the switch blade to come out, and then it will pull it in again, leaving it to the oil switch to open the circuit. Some experiments in this direction are desired.—*Editorial Suggestion.*

TRANSMISSION LINE, ARTIFICIAL, WITH ADJUSTABLE CONSTANTS.

The present type of artificial transmission line, with its fixed inductance coils and condensers, does not permit of a ready adjustment of reactance and capacity per unit strength. On large transmission systems, where new branches are being projected and new interconnections considered, it would be of great convenience to possess an artificial transmission line with easily adjustable constants. Such a device could be set up and loaded in the laboratory to correspond to a new line, and its performance directly obtained without comparatively tedious computations involving complex quantities and hyperbolic functions.—*Editorial Suggestion.*

TRANSMITTER, TELEPHONE, RELATION BETWEEN PRESSURE AND RESISTANCE.

Prof. G. D. Shepardson in his book on "Telephone Apparatus," page 101, states that published data seem to be wanting upon the relation between pressure and resistance for modern transmitters of the carbon-cell type. Here is a fruitful field for investigation with the view to a rational transmitter design.

THERMO-COUPLE, TUNGSTEN-MOLYBDENUM.

Referring to the suggestion on this subject published in the Research Section in Vol. 74, page 370, Aug. 16, 1919, I wish to call attention to the tungsten-molybdenum couple. I reported upon it briefly at the eighth international congress of applied chemistry (*Proceedings*, Vol. 26, page 505), 1912, and a further investigation would no doubt lead to some practical design of this couple.—*Colin G. Fink, New York City.*

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

Radio Stations Taken Over by Government to be Returned to Owners

BY AN executive order of the President, all radio stations and systems taken over by the federal government and now held by it under authority of executive orders of April 3 and April 30, 1917, will be returned to their owners at midnight of Feb. 29.

All restrictions that were placed on radio stations not necessary to the government for naval communications will be removed at the same time, after which the control and operation of all such radio stations will be subject to the provisions of the act to regulate radio communication approved Aug. 13, 1912.

Rocky Mountain Geographic Section of N. E. L. A. Proposed

THE New Mexico Electrical Association will withdraw from the Pacific Coast Section of the National Electric Light Association and join with the state associations of Colorado and Wyoming to form the Rocky Mountain geographic section of the national body. Action to that effect was taken at the sixth annual convention of the association, held at Albuquerque, N. M., on Monday, Tuesday and Wednesday of this week. President Ballard of the National Electric Light Association, together with William H. Onken, Jr., editor of the ELECTRICAL WORLD, attended the convention for the purpose of explaining the geographic section plan and how state associations are tied in with it and with the national headquarters at New York. As in the case of Colorado and a number of other states having effective state organizations, no change is contemplated in the activities of the state organizations, which will function as heretofore. Delegates will be appointed to meet with delegates from other state organizations in conference, and this conference committee will form the geographic section.

A very good program was provided for the meeting, and the subjects were diversified to cover the needs of the smaller utilities. Much interest was manifested in national association matters and in the visit of President Ballard. The program was as follows: Presidential address by D. W. Morgan of Las Cruces; "The Coal Situation," by D. E. Bent of Tucumcari; "Fire Loss by Electricity," by L. A. Barley of the Rocky Mountain Fire Underwriters' Association, Denver; "The Legislative Situation," by Albert Simms, legal adviser of the association; "The Outlook for Electrical Merchandising," by J. J. Cooper of the Mountain Electric Company of Denver; "The California Electrical Co-operative Campaign," by K. E. Van Kuren of the Westinghouse Electric & Manufacturing Company, Los Angeles; "The National Electric Light Association," by President Ballard; "The Electrical Outlook," by W. H. Onken, Jr., editor of the ELECTRICAL WORLD, New York; "Developments in the Industry," by B. C. J. Wheatlake of the General Electric Company of Denver; "Public Relations of Public Utilities," by J. F. Greenawalt of the Mountain States Telephone & Telegraph Company of Denver; "Battery-Charging Load," by Prof. R. W. Goddard of the New Mexico College of Agriculture and Mechanic Arts; "Lighting," by R. M. Merrill of the National Lamp Works of Cleveland, Ohio; "The Lamp Industry," by E. A. Dacis of the Los Angeles office of the Westinghouse Lamp Company; "Distributing Transformers," by D. C. Lamaree of the Westinghouse company's Los Angeles office.

E. A. Roberts of Carlsbad was elected president of the New Mexico association for the ensuing term.

Northwest Developments Await Passage of Water-Power Bill

CONSIDERABLE hydro-electric work is reported to be projected in the Northwest which will be delayed until the final passage of the pending water-power bill.

E. P. Hopson of Portland, Ore., has filed two applications with the state engineer for permits to appropriate water for commercial light and power purposes—one calling for the development of 18,000 theoretical horsepower at a cost of $1,300,000 in Crook County and the other for the development of 43,000 theoretical horsepower at a cost of $1,500,000 in the same county. It is reported that work will begin on these projects immediately after the enactment of the federal legislation now pending which will permit the utilization of water power from sources in public lands.

According to an unofficial report, the Northwest Electric Company of Portland has under consideration the erection of a five-million-dollar power plant in the North Fork of Lewis River, work to begin this summer.

Interconnection Proving Its Worth

HYDRO-ELECTRIC companies in New England are handicapped at this time by low water, due in large measure to the freezing of small tributary streams in their upper watersheds, but every possible effort is being made to conserve the joint resources of the water-power and steam companies. Interconnection is playing a helpful part here, notably between the New England Power, Boston Edison, Eastern Massachusetts Electric, Narragansett Electric Lighting, Turners Falls Power & Electric, Connecticut Power and Hartford Electric Light companies and the steam and hydro-electric installations of the Connecticut Light & Power Company. The normal rating of the new Stevenson hydro-electric station of the Connecticut Light & Power Company is 18,000 kw., but this was reduced by low water last week to about 5,000 kw. or 6,000 kw. With the Housatonic River responding to warmer weather, this plant will carry at least 75 per cent of the important industrial load of the company in the Waterbury-Bristol district. For a time last week the Worcester Electric Light Company was obliged to cut its supply of energy to the New England Power Company, but this was resumed Monday.

News in Brief

SUMMARY

of Important Happenings in the Industry During the Week

THERE has been relatively little movement of electrical material in the East this past week. Freight embargoes, delayed traffic and a general slackening in actual electrical construction work because of the cold have kept business on a lower level than has been occupied for some time. Delayed deliveries are keeping raw materials from the mills and causing finished products to pile up in warehouses. In most cases demand is limited only by supply. Especially do shortages exist in all the conduits, wiring porcelain, porcelain for switch bases and cut-outs, lamp and heater cords, flexible armored conductor, metal molding, labor-saving devices and hollow ware. The demand is high on all these articles and also for sewing machines, tape, line material, heavy cooking devices, lamps, refrigerators and industrial trucks, although the supply of the latter is in fair shape. Price advances have been applied to loom, Torrington vacuum cleaners, Edison storage batteries, Westinghouse turbines, metal molding and cotton insulating materials.

COLLECTIONS are falling off a bit because of tight money and poor mail service and are being watched closely by jobbers. Building plans for spring construction are progressing at a good rate all over the country.

THE Hydro-Electric Power Commission of Ontario is endeavoring to purchase energy to supply the needs of its power customers. It is reported to be 40,000 hp. short of its contract requirements. An increased power rate is likely to follow any purchase of electricity by the commission.

PRESIDENT BALLARD of the N. E. L. A. was welcomed warmly at Atlanta by members of the Southeastern Section.

THE Electrical Credit Association of Chicago has decided to change its name and will probably become the Central Division of the National Electrical Credit Association.

THAT farm-lighting plants offer a big field for electrical jobbers was brought out in the course of a meeting of the Central Section of the Electrical Supply Jobbers' Association at Chicago. W. R. Herstein of Memphis was elected chairman for the ensuing year.

ALL the radio stations and systems taken over by the federal government in the war will be returned to their owners at midnight of Feb. 29 and the pre-war provisions governing such plants will thereafter be in force.

THE stockholders of the Hartford (Conn.) Electric Light Company have voted to purchase the Connecticut Power Company, thus facilitating both expansion and economy.

AS THE result of vigorous action by public officials, public utility executives and business men the outlook for an adequate coal supply in the New England States is more encouraging.

THE interconnections now existing among New England electric companies have proved of great value in meeting the conditions of inadequate power supply caused by frozen streams.

CONSIDERABLE hydro-electric development in the Northwest, including two or three large projects in Oregon, awaits the passage of the water-power bill now in its last Congressional stages.

THE Society for Electrical Development announces renewed activity among its members following the period of curtailment imposed upon them by the war policy of retrenchment in expenditures.

AT A HEARING before the President's Coal Commission the public service utilities protested against the coal operators being permitted to pass on to them the increase in price occasioned by the 14 per cent raise in miners' wages, as well as against recent confiscations by the Railroad Administration of fuel consigned to them. Representatives of the National Electric Light Association declared their adhesion to the policy of summer storage of coal in still greater measure if this can be made feasible.

AT THE sixth annual convention of the New Mexico Electrical Association, held in Albuquerque this week, it was determined that the association would withdraw from the Electric Light Association and join with the state associations of Colorado and Wyoming to form the Rocky Mountain geographic section of the national body. E. A. Roberts of Carlsbad was elected president of the association.

IMPORTANT meetings scheduled for early dates are: Commercial Section, Indiana Electric Light Association, Fort Wayne, Ind., March 4; Southwestern Electrical and Gas Association, Galveston, Tex., May 13, 14 and 15; Ohio Electric Light Association, Cedar Point, Ohio, July 13 to July 16; Oklahoma Utilities Association, March 9, 10 and 11.

PRESIDENT CALVERT TOWNLEY of the A. I. E. E. in his address at the midwinter convention of that body, held in New York this week, urged strongly that engineering bodies should make their influence felt in public affairs. He dwelt on the accomplishments of the Engineering Council and discussed a plan already in process of organization for obtaining representation of the engineering bodies in civic and other public movements.

HERBERT C. HOOVER in his inaugural address as president of the American Institute of Mining and Metallurgical Engineers discussed at length the economical situation of the nation.

THE fifth annual meeting of the Associated Manufacturers of Electrical Supplies will be held in New York City on March 18. Section meetings will be held previously.

IN AN endeavor to interest factories in greater light intensity as a vital factor in increased production, the Illuminating Engineering Society is to assist and sponsor a committee of ten.

THE Consumers' Power Company of Michigan is planning a new steam station with a probable rating of 40,000 kw. for operation on its interconnected system of hydraulic and steam plants.

WATERWHEELS of Allis-Chalmers build, resembling ship propellers in appearance and designed to give high speeds at low heads, have been installed in the Plainwell (Mich.) station of the Consumers' Power Company, where 164 r.p.m. at 12-ft. head is obtained from them.

A CONFERENCE of the engineers of the California State Railroad Commission was held in San Francisco on Feb. 17 to consider means of meeting the drought situation, which is the worst in the history of the state. Northern California will have a power shortage of 25 per cent this summer if the dry spell continues, according to Power Administrator Butler. Conditions in the agricultural sections of the Sacramento Valley are serious.

Manufacturers to Meet in Week of March 15

THE fifth annual meeting of the Associated Manufacturers of Electrical Supplies will be held at the Waldorf-Astoria, New York City, on March 18, for the election of governors, presentation of reports and other business. In the evening the fifth annual banquet will be held.

Following is a schedule of the section meetings to be held during the week of the annual meeting, commencing March 15, at the offices of the association, and at the rooms of the Old Colony Club, Manhattan Hotel:

Monday, March 15.—At the association rooms: Industrial Lighting Section, 10 a.m.; Signaling Apparatus Section, 2 p.m.

Tuesday, March 16.—At the Old Colony Club: Outlet Box Section, 10 a.m.; Line Material Section, 2 p.m. At the association rooms: Snap-Switch Section, 10 a.m.; Molded or Formed Insulation, 10 a.m.; Lamp-Receptacle and Socket Section, 2 p.m.; Air-Circuit-Breaker Section, 2 p.m.; Attachment-Plug Section, 4 p.m.

Wednesday, March 17.—At the Old Colony Club: Fan-Motor Section, 10 a.m.; Rigid-Conduit Section, 10 a.m.; Non-Metallic-Conduit Section, 2 p.m.; Armored-Conductor Section, 4 p.m. At the association rooms: Panelboard and Switchboard Section, 10 a.m.; Fuse Section, 10 a.m.; Knife-Switch Section, 2 p.m.; Electrical Porcelain Section, 2 p.m.

Utilities in Sympathy with Coal Storage Plan

PROTESTS against permitting coal operators to pass to consumers the 14 per cent wage increase awarded the miners were registered before the President's coal commission on Feb. 17 by representatives of several public utility associations. The confiscation and diversion of public utility coal by the Railroad Administration also came in for severe condemnation. Some of the public utility witnesses told the commission that they regarded it essential to continue in force the government restrictions on coal until normal conditions have been restored.

George W. Elliott, of the National Committee on Gas and Electric Service, was the first witness. He called attention to the fact that public utilities use 50,000,000 tons of coal annually. With 98 per cent of this coal bought on contracts, the public utilities have been hard hit by the action of the coal operators in passing on the 14 per cent increase to them, he said.

M. H. Aylesworth, general manager of the National Electric Light Association, among other things urged that steps be taken to make it profitable for public utilities companies to buy coal at summer prices for storage. He told of the additional expense occasioned by the rehandling made necessary by the storage of coal. At this point in his testimony Chairman Robinson asked whether, in view of the general public's dependence on public utilities and of the fact that many thousands of mine workers are seriously affected by the seasonal character of the purchases of coal, it were not the duty of public utilities companies to store coal even if the cost to them should be greater. Mr. Aylesworth replied that it is his personal conviction that it is their duty.

Charles Edgar of Boston, representing the National Electric Light Association, said that the Boston Edison Company has a storage capacity for 100,000 tons of coal but is unable to utilize all of this owing to the fact that deliveries of coal cannot be had in summer months. It has been the practice of the Boston company to store three months' supply of coal during the summer, he testified, while the practice of the New York Edison Company is to enter the winter with a two-months' supply. Inability to get coal last summer found the New York company at Christmas time with a margin of only 20,000 tons of coal. He declared that public utilities companies generally are in entire sympathy with the storage plan.

Townley Urges Engineers to Participate in Public Affairs

Midwinter Convention of the A. I. E. E. Is Largely Attended—President Discusses Nature and Purpose of National Engineering Body

A LARGE attendance of members, many from other sections of the country, marked the midwinter convention of the American Institute of Electrical Engineers, which was held on Wednesday, Thursday and Friday of this week at the Engineering Societies Building, New York City. Technical sessions were held on all three days. These will be reported in next week's issue of the ELECTRICAL WORLD. Visits of inspection to the plants of the New York Edison Company, the Brooklyn Edison Company, the United Electric Light & Power Company, the American Telephone & Telegraph Company and other utilities, and to the Electrical Testing Laboratories, were made by many of the delegates. On Thursday evening the customary dinner-dance was held at the Hotel Astor.

President Townley opened Wednesday night's meeting with an address regarding the organized participation in national affairs by engineers. He stated that it had been decided to operate through the agency of representatives of the engineering societies rather than by the formation of one national society of engineers. He urged particularly that this body of engineers should confine itself to activities in which the engineer's advice is of particular value, as distinguished from political and other general problems. It was said that several of the national engineering societies have already approved of the plan, and conferees have been appointed to consider the organization of this engineering body. President Townley attributed a large share of this accomplishment to the A. I. E. E. development committee.

"It would be premature," said Mr. Townley, "not to say hazardous, to say now that if and when delegates from a large number of societies come together they will organize, and their sponsors will support a federation such as has been proposed by the joint conference committee, but at least the national societies will have done their duty, and if the plan should carry it will place in the hands of a democratic body of engineers chosen from engineering organizations of every kind all over the United States a large measure of authority and responsibility to speak for the engineering profession and to take united action on matters of common concern. It is because of the far-reaching character of this prospective step that I have chosen to speak to you about it tonight. I regard it as one of the most important of the organization matters which are today before the engineers of the country."

In discussing the probable activities of such a national

engineering body Mr. Townley pointed to some of the things which have already been done by the Engineering Council. The Council was organized during the war and its first activity was to help the government to find engineers suitable for the many different tasks for which they were sorely needed. They helped to pass upon the merits of an enormous number of devices, processes, methods and inventions, all of them new and untried. Since the armistice the Council has co-ordinated and expanded the employment bureau maintained over a period of years by some of the national societies. It is also conducting an exhaustive examination into the classification and compensation of engineers in government service. In co-operation with the United States Chamber of Commerce the Council has given material aid toward the passing of the water-power legislation in both the House and Senate.

In undertaking such important work the speaker pointed out the necessity of putting strong men into office in the national engineering body, men on whose judgment engineers can rely and who may be counted upon to have the courage of their convictions both to act when necessary and to refuse to act in the times, much more numerous, when matters beyond the purview of their organization are proposed. There must be remembered also the necessity for authority to act without reference to the supporting bodies for approval.

New Organization to Consist of Delegates From Existing Bodies

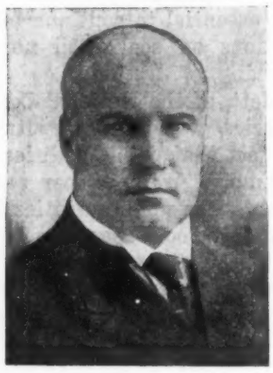
"One of the fundamental features," the speaker said, "of the plan prepared by your development committee, and which also appears in that adopted by the joint conferees, is that the new national organization shall be composed of delegates from existing engineering bodies. It will not be a new society composed of individual members. Such a plan was given exhaustive consideration by the conferees and in the end decisively rejected." He pointed out the futility of attempting to organize and maintain a large society of all engineers and said that, in spite of all the efforts put into organization of engineering societies since the beginning, more than half the engineers of the country belong to no engineering organization at all, and that there has been an undoubted tendency to split off and subdivide rather than to unite.

"The primary objection to the plan adopted," said Mr. Townley, "is that the work of the new organization is to be quite different from that in which most of the old organizations have been engaged. Instead of dealing in the main directly with technical or inter-organization matters, it will deal more largely with public affairs, and as the existing societies are not organized for this purpose and in fact have not only not done it but have in some instances shown opposition to the idea, they should not be relied upon to back it now, but on the contrary an entirely new body should be created, one that is not hampered or shackled in any way. The answer to this argument is that, while the existing societies were not organized for the kind of work now contemplated, several local affiliations of them have been functioning around many of the sorts of work proposed for a number of years and doing it very well, and that the Engineering Council has already proved its efficiency and only needed a larger appropriation and the more representative membership to be afforded by the new plan to occupy a much wider field."

The requests for financing the work of the conference have been modest, Mr. Townley asserted, and later on, if the organization is formed and has a chance to demonstrate its value, the engineers of the nation will have ample information on which to alter the dues if they see fit.

"The only other comment which I feel should be made," said Mr. Townley, "is a word of caution, and is born of my experience while serving the Institute on Engineering Council. That body has been beset on all sides to advocate or to oppose legislation, and while it has not hesitated to do so when the questions involved were of a nature where the advice of engineers would be of particular value, it has steadfastly declined to become involved otherwise. Bearing this fact in mind, my word of caution is against any policy which will cheapen the engineer. Our collective advice is valuable on subjects with which we are qualified by experience and training to deal, and so long as we confine ourselves to such subjects and present a united front our influence can and will be considerable. But the minute we digress and begin to deal with matters outside the purview of engineering and subjects closely allied thereto we sacrifice our preferred position and have no more claim to be heard than any body of educated citizens of similar numbers. We also would then almost certainly make the very serious mistake of misrepresenting our membership, because, while engineers can be safely counted upon to agree on fundamental facts, they are of all shades of political belief and have as many different views as any one else regarding other questions. My word of caution therefore is really a plea to you to give this side of the subject your due thought and to make your views known at all proper times and places."

Water Power Advocate Leaves Cabinet



FRANKLIN K. LANE

Secretary of the Interior Lane, whose resignation from the Cabinet will take effect March 1, has earned the warm approval of all interested in electrical development by his vigorous and persisent advocacy of a water-power bill fair alike to the public and the investor. To him is due much credit for the bill now in the last Congressional stage.

Big Companies Resume Membership in Society for Electrical Development

RENEWED activities in development work by the Society for Electrical Development are under way after the period of curtailment imposed upon members by the war policy of retrenchment in expenditures. Many of the larger utilities and commercial organizations in the industry have resumed their membership in the society. The consequent increase in available funds will enable the society to function in a fuller way than has been possible now for many months.

In a statement to the ELECTRICAL WORLD James M. Wakeman, general manager of the society, says: "During the war the Society for Electrical Development was obliged to restrict its activities, although it continued throughout to do all its curtailed budget permitted and 'carried on' sufficiently to justify the subscriptions of those members who supported it. During the past three months so many of the big companies have resumed their membership—the General Electric Company, Commonwealth Edison Company, Edison Electric Illuminating Company of Boston, Consolidated Gas, Electric Light & Power Company of Baltimore, Middle West Utilities Company, etc.—that the funds available for the society's work are more than 50 per cent greater than at the time of the November meeting of the board of directors."

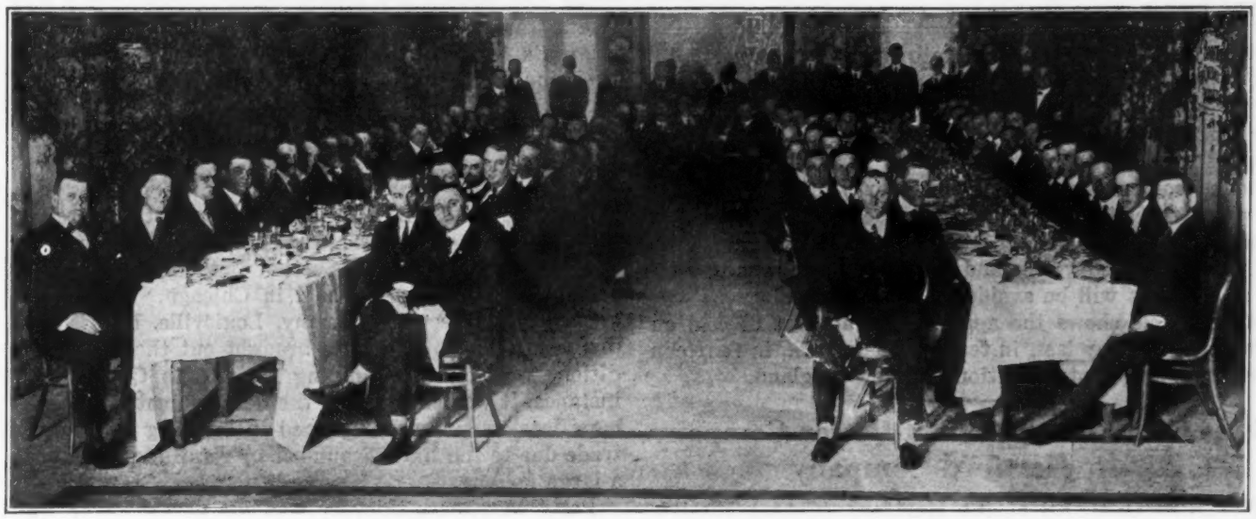
The society was established in the year before the war, and since then, in addition to its various other endeavors, has successfully conducted three national electric weeks. Henry L. Doherty was president of the society from the beginning until last November, when he was succeeded by W. W. Freeman, president of the Union Gas & Electric Company, Cincinnati.

South Enthusiastic Over Plans of the N. E. L. A.

AT A LUNCHEON given by the Georgia Railway & Power Company to R. H. Ballard, president of the National Electric Light Association, the interests of the geographic sections received considerable impetus. The luncheon was attended by most of the leading men in the electrical field in the Southeastern Section of the N. E. L. A. Mr. Ballard outlined in a lucid manner his plans for a much broader field of association work than heretofore, a radical departure from precedent being evidenced in his expressed desire to interest the manufacturing and jobbing fraternities as well as the central stations in the value to them of the national association.

He particularly stressed the importance of the geographic sections proceeding upon well defined co-operative plans so as to weld all progressive men in the electric field into one constructive organization. Mr. Ballard's ideas were received with enthusiasm by those present at the luncheon.

In addition to the constructive work discussed by Mr. Ballard, both he and William H. Onken, Jr., editor of the ELECTRICAL WORLD, by whom he was accompanied, touched upon the broader phases of the industry and outlined the tentative program for the coming convention at Pasadena.



DINNER GIVEN BY ELECTRICAL MEN OF NEW ORLEANS TO R. H. BALLARD, PRESIDENT OF N. E. L. A.

Messrs. Ballard and Onken left Atlanta for New Orleans, the second stop in their journey to the Pacific Coast. Here they were the guests at a trade dinner attended by ninety-two representatives of the central-station, electrical jobbing, contractor-dealer and electrical manufacturing interests of the city.

H. L. Doherty & Company Optimistic

In a brief preliminary report of the operations of the Cities Service Company in 1919, Henry L. Doherty & Company strike a note of optimism. Under the company's system each manager is required to prepare a forecast of what the coming year will mean to his property. These forecasts, which have just been summarized, point very clearly to a record year in every department, and the company declares its absolute confidence that the earnings of public utilities accruing to the Cities Service Company for 1920 will be the greatest in the history of the organization. In other words, it feels that the utility division is now making progress on a basis indicating that the handicaps occasioned by the war have been met effectively and that renewed progress in this department of activity can be anticipated.

Coal Supply for New England Utilities More Encouraging

NEW ENGLAND central stations entered the week with no small anxiety as to their coal supply, following repeated commandeering of coal in transit by the railroads. Some of the larger companies have been obliged to pull down their coal stocks to levels representing from two to three weeks' operation at this season, and strenuous efforts are being made by state governors, Fuel Administrator James J. Storrow and leading utility and business interests to obtain something like a normal flow of coal into the district. In response to these representations, the Railroad Administration by the first of the week had begun to resume the delivery of coal to public utility consignees to an encouraging extent; so that while the situation at this writing is extremely critical in many cities in the interior and none too certain at the tidewater stations, there is reason to believe that, if no further general diversion occurs and if the utmost energy is devoted to transporting coal into New England, general shut-downs of central stations will be avoided.

ESTIMATED DAY'S RUN OF COAL ON HAND IN FOURTEEN LARGE NEW ENGLAND CENTRAL STATIONS AS OF FEB. 16, 1920.

Company or City Served	Day's Supply	Company or City Served	Day's Supply
Bridgeport, Conn.	21	Portsmouth, N. H.	17
Boston, Mass.	14	Providence, R. I.	21
Brockton, Mass.	17	Salem, Mass.	31
Cambridge, Mass.	60	Springfield, Mass.	7
Hartford, Conn.	14	Waterbury, Conn.	7
Lowell, Mass.	42	Worcester, Mass.	10
Manchester, N. H.	14		
New Bedford, Mass.	21	Average	21

The table shows the approximate amount of coal on hand on Monday last, in terms of days' run, in fourteen of the larger central stations in New England.

Purchase of Connecticut Power Company by Hartford Company

STOCKHOLDERS of the Hartford (Conn.) Electric Light Company voted at the annual meeting on Feb. 10 to purchase the Connecticut Power Company, as was anticipated in a recent issue of the ELECTRICAL WORLD. The stockholders of the latter company have not as yet passed upon the transaction, but it is expected that it will be consummated without difficulty. The acquisition of the Connecticut Power Company will enable the Hartford company to expand its service advantageously, devoting more energy to wholesale distribution.

The Connecticut Power Company possesses a franchise to do business anywhere in the state and already supplies a developed business which will earn more than $300,000 per year above the interest charges on its bonds. This company has a paying business in New London, Middletown, Bristol, Thomaston and elsewhere, but except for water power has no generating stations. The water-power plant is at Falls Village, has a capacity of about 10,000 hp. and cost about $1,000,000. It is connected with central Connecticut by a 66,000-volt transmission line tied into the Hartford system, and this line will be extended southeasterly across the state to interconnect these systems with that of the Eastern Connecticut Power Company in the New London district, and thence with the lines of the New England Power Company. Electrical continuity will then be realized from Salem and Boston, Mass., and Providence, R. I., to Falls Village and Derby, Conn.

In a statement to a representative of the ELECTRICAL WORLD, the management of the Hartford company points out that its policy will be to sell power to various local distributing companies, but not to own or control the policies of such companies. It is believed that no relief can be looked for in the price of fuel, and economies in its use require the employment of larger generating units than are at present in service at Hartford. In the last five years the size of steam turbines at Hartford has increased from 4,000 kw. to 10,000 kw. rating, with the result that the company's fuel cost per kilowatt-hour has increased only 42 per cent despite the doubling of the price of coal.

The business in Hartford alone is not sufficient to warrant a station of the size needed for efficient operation, and it becomes necessary for the Hartford company to sell its surplus energy to other cities, this being permitted by the Connecticut Power Company's franchise. The Hartford company has a generating capacity of 37,500 kw. at present, serves 35,500 customers and consumes 73,000 tons of coal annually, its station rate being 2.01 pounds per kilowatt-hour. Plans for a new steam station, to be equipped with 20,000-kw. generating units, are being prepared for the Hartford company by Stone & Webster, Boston.

Farm-Lighting Plants Big Field for Electrical Jobbers

WITHDRAWAL of the jobber from retail merchandising received considerable attention at the Feb. 9 meeting of the Central Section of the Electrical Supply Jobbers' Association held in Chicago. Paul Tafel, of the Tafel Electric Company, Louisville, Ky., led the discussion, in which it was brought out that local conditions were the determining factor. In Chicago, for instance, it was shown that the development of the jobbers' local business had helped in building up a retail trade due to the limited number of retail stores in such a large field.

Petty warehouse thievery was due partly to the lenience of the jobbers in the prosecution of offenders. It was thought that a firm stand in this matter would be beneficial to the jobbers' organization, V. G. Eastman stated in a discussion of this subject. B. B. Downs of St. Paul pointed out some of the methods to use in building up a farmhouse lighting outfit business and gave typical costs per lighting unit in building up such a business. His figures showed the enormous field for this class of jobbers' trade, and he made the statement that with all of the manufacturers of lighting outfits pushing the sales to the maximum there would still be business for all.

Picking the right man for the organization was the subject covered by Martin J. Wolf, St. Louis, who built up a hypothetical jobbers' organization showing the characteristics of the men required to fill the different positions successfully. Price reductions do not stimulate business as a whole, said R. P. Oblinger, and price cuttings should not be resorted to unless for the sake of moving obsolete lines, in which case it would be better to make arrangements with old customers who might benefit by this price reduction.

Plans for the trip of the Central Section to San Francisco in June were discussed. About seventy members have already signified their intention of making the trip. W. R. Herstein of Memphis was elected chairman for the ensuing year.

Ontario Hydro-Electric May Have to Increase Power Rates

ARRANGEMENTS are under way by the Hydro-Electric Power Commission of Ontario, Canada, to obtain power from other sources in order to meet the demands on the system until the Queenston-Chippewa development has been completed. Consumers on the Hydro system are being asked to state their 1920 requirements because the additional power will be limited.

Up to the present the Hydro-Electric Commission, so far as could be learned, has advanced rates for power in Ontario only by cutting the 20 per cent prompt payment discount to 10 per cent. The commission states, however, to its power customers that the additional power required, which must be purchased, will cost the commission more and that the increased cost will have to be passed on.

At the present time the commission is generating and purchasing about 265,000 hp., which is reported to be 40,000 hp. short of its contract requirements. At times, however, during this winter the generating plants, because of troubles from ice and bad operating conditions, have been affected to a still greater extent. On Jan. 31 the shortage, reports state, was increased by more than 100,000 hp. Supply interruptions to customers as a result of these conditions have naturally become more frequent.

Farm-Line Standardization Proposed

A PRELIMINARY report covering the standardization of farm lines was drawn up at a recent meeting of the farm-line committee, Iowa section, N. E. L. A. This report will be subject to revision at a June meeting.

A detailed study was made of the standard minimum requirement specifications for farm-line construction. These specifications call for rural service lines of good sound material constructed in a workmanlike manner. Poles, cross-arms and hardware are to conform to a standard practice. Insulators are to be of a good grade of brown porcelain such as are regularly used by the operating companies of the state. Poles are to be set in the ground the proper depth, according to their length. Lightning arresters are to be graded shunt, multi-gap or low equivalent type. Horn-gap arresters shall not be used owing to the belief of the committee that they set up dangerous surges when arcing over on one side of the line.

The committee recommends that each farm line be dealt with as a wholesale consumer when possible and that 25 kva. be the smallest substation tapped in on 33,000, 16,500, 13,200 and 11,000-volt lines. All farm lines outside of incorporated towns should be and remain the property of the farmers, to be operated and maintained by them. In this connection sample articles of incorporation, notice of incorporation and method of petitioning the Board of Railroad Commissioners for a franchise to erect and operate transmission lines are included in the report.

It was the general opinion that a service charge plus a small rate per kilowatt-hour for all energy is the ideal rate. Definite figures were postponed until more data should be available showing the losses and power factor of farm lines. A general scheme is given of proposed rates which seem to meet the general conditions. The report includes a standard form of contract with the suggestion that all farm-line contracts be made for long periods, say twenty years, with a readjustment clause at the end of one, two or three years.

Large Steel Mill Has 118,000 Hp. in Connected Load

Twenty-three of the 2,169 Motors Have a Horsepower of 37,000—Alternating Motors Represent 27 per Cent of Number and 55 of Horsepower

THE degree of electrification which has been obtained at the Maryland plant of the Bethlehem Steel Company was indicated the evening of Feb. 7 by R. B. Gerhardt, superintendent of the electrical department, in a paper presented before the Philadelphia Section of the Association of Iron and Steel Electrical Engineers. He said that there are 2,169 motors on the electrical system, representing a total connected load of 117,850 hp. From the time that the ore and coal arrives by steamer or by cars to the time when the finished product is loaded onto cars, electricity plays a most important part. Not only is electrical energy used for transporting and handling the material, but it is fully utilized to insure safety and in many cases automatic operation. The accompanying table indicates the extent to which electricity is being used in different departments.

Plant	Number of Motors	Connected Horsepower	Kw.-Hr. Per Ton of Material Handled
Ore handling	60	3,618	1½—2
Coal handling	56	4,101	——
Coke oven — total	174	8,035	1.3
Blast furnace (includes blowing engine house, ladle house, pig-casting plant, skull-cracker plant, sintering plant)	96*	10,887	6.9†
Bessemer and open hearth No. 1	96	4,711	——
Open-hearth, No. 2	141	7,947	4.6
Bloom and rail mills	136	5,190	——
Bloom, billet and bar mills	181	18,474	20.8
Sheared plate mill (36 in. by 110 in.)	122	8,653	44.0
Universal plate mill (60 in.)	126	10,128	——
Sheet and tin-plate mill	96	6,070	——

* There are also six lorry cars and seven cranes in this department.
† Excludes casting plant and sintering plant (sintering plant averages 15.5 kw.-hr. per ton of sinter.)

Energy for this load is supplied from two sources, about 17,000 kw. being available from Baltimore and the remainder from 5,000-kva. gas-engine-driven generators, of which there are five though only three of them are now in operation. This gas-engine plant is designed to have an ultimate rating of 100,000 kva. The mill is fed by means of a distribution system which consists of a 6,600-volt double-bus circling the mill and connected with four switching stations that serve the principal substations. An interesting feature of the distribution circuits is that they are made of 1,000,000-circ.mil. double-braid weatherproof cable instead of bare wire on account of the gaseous condition of the atmosphere which would corrode copper.

It was brought out in the discussion of the paper that the load factor was approximately 60 per cent. This is calculated from power-demand readings required by the contract with the central station and the installed generator rating at the mill. About 580 of the motors are operated on alternating current having a connected load of 64,000 hp., 23 high-voltage mill-type motors representing a connected load of 37,000 hp.

The Human Side of Engineering

Opportunities and Responsibilities of the Profession—Pure and Applied Science Must Work Hand in Hand—Make the World Safe for Science

THAT the engineer, as his paramount duty in a changing century, must dedicate himself to the great problems of humanity and safeguard civilization by controlling science for beneficent purposes was the declaration of President Ira N. Hollis of the Worcester (Mass.) Polytechnic Institute in an address before the Associated Engineers at Nashville, Tenn., on Jan. 19. The engineer's place must become increasingly important, and if the world is to grow better, he must strive to exert his influence in the direction of righteousness, working for the good of mankind rather than for the ambitions of nations, the speaker said. Engineering as it is coming to be understood invariably has within it the element of construction and the employment of energy in some form, but in addition the human side of industry must be considered. In modern times this has become an immensely important part of the profession, and engineers can never reach a position of commanding influence as citizens without taking it into consideration.

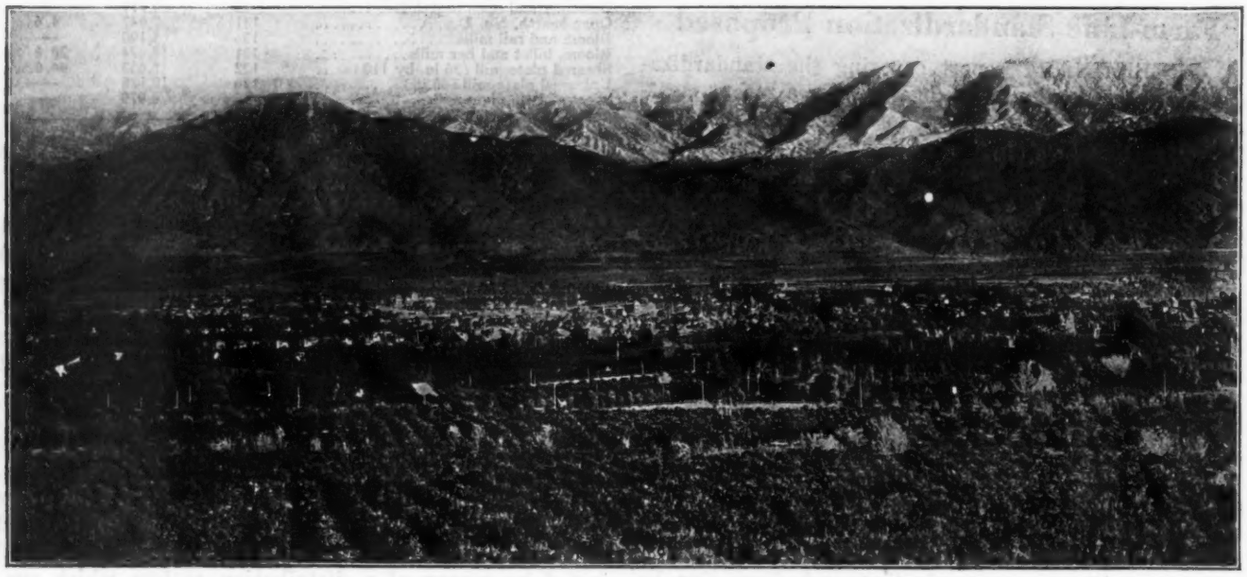
Pure and applied science can never be separated if the whole truth is known with regard to any problem, Dr. Hollis continued. Engineers have only recently awakened to the importance of research and of a complete study of every problem set before them. Scarcely a problem has been exhaustively investigated. Research is still in its babyhood, while application is older than history. Many investigations undertaken by engineers suffer from the lack of adequate training in physics. As a rule, engineering schools offer too little physics, generally on the ground that engineering is commercial and that the profession has no time to deal with the minute quantities and small measurements of the laboratory.

"The sooner we get away from the differences and jealousies now existing among our national specialty societies and their local societies of engineers, big and little, and form one United States Engineering Society with a building of its own in Washington," Dr. Hollis said in conclusion, "the sooner we shall come to the same commanding influence over public affairs as our compatriots in business have already attained. There is plenty of room for the professional societies as they are now constituted, but there is an absolute need for something either planned through the national societies already existing or developed out of the local societies rapidly coming into existence. There is no reason why the effort of the Engineering Council should not be the beginning and nucleus of a larger idea."

Delegates to Pick Oranges at Pasadena N. E. L. A. Convention

IT HAS been arranged as one of the features of entertainment and education for the delegates who attend the convention of the National Electric Light Association at Pasadena next May that they shall have opportunity to go into fine orange groves that lie close by in the San Gabriel Valley and pick the golden fruit from its tree. Tours of the "empire of the orange" are being arranged for delegates, and those familiar with the industry will take pleasure in pointing out the practical side of electric application.

In southern California practically all of the orange groves are under electric irrigation. Lands that were once semi-arid sheep pastures have been brought under intensive cultivation by the electric motor, which, year by year, is reclaiming the desert.



N. E. L. A. DELEGATES WILL PICK ORANGES HERE NEXT MAY

From a load-factor standpoint, irrigation of the orange groves will be intensely interesting to electrical men, but electric pumping is only one feature of the orange industry. The orange packing house is today operated entirely by electricity. First the fruit is washed by electrically driven washers. Then the brand label is placed on it by another electric device. It next finds its way into the electric sorter, in which the oranges are graded for the market. Even the boxes are made and nailed up by electric machinery, and in some of the largest packing houses there are many electric labor and time-saving devices.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Pueblo Saves $10,000 a Year by Electrical Pumping.—Pueblo, Col., uses electrically driven pumps in the waterworks of the city, the first large unit, with a daily capacity of 3,000,000 gal., having been installed in 1918. The trustees estimate an annual saving of $10,000 with complete electrical equipment.

World Trade Club Advocates Metric System.—The World Trade Club of San Francisco is circulating "Metric Literature Clues," an index to books and articles on the standardization of weights and measures, with the object of promoting the adoption of the metric system in the United States and Great Britain.

Electricity in the Army.—As a result of a survey now being made by the General Staff of the United States Army it has virtually been decided that electrical cookers and other electrical equipment shall be used at army posts to the exclusion of other appliances where the cost of electricity is 3 cents a kilowatt-hour or less.

Surcharge to Stay Pending Decision.—Pending the Railroad Commission's final decision in the matter of the application of the San Joaquin Light & Power Corporation for an increase in rates, the surcharge of 15 per cent which the company has been collecting will remain in effect. The commission has issued an order to this effect.

Fire Losses from Electricity.—Figures prepared by the National Board of Fire Underwriters show that damage from fires of electrical origin in 1918 was $894,785 more than in 1917 and $4,220,874 more than in 1916, the increased loss being due to the wider use of electrical energy. Losses from this cause in New York State reached $2,746,956, and in Pennsylvania they were $2,351,088.

Engineering Council's Campaign for Funds.—At a conference of the governing bodies of the member societies of the Engineering Council held in New York recently it was recommended that each of the four founder societies should contribute for 1920, $5,000 toward the work of the council instead of $3,000 as hitherto, and that the American Society for Testing Materials should contribute $1,000 instead of $600. In addition to this, every member of the constituent societies except junior and student members will be asked for a contribution of $2. It was declared that without increased financial support the public welfare work of engineers will be seriously discredited.

Extension of Time for Selling Stock.—The Western States Gas & Electric Company has received permission from the California State Railroad Commission to extend the time in which to sell the $178,000 preferred stock authorized by the commission last year. The time is now fixed as Dec. 31, 1920.

The Electric Brass-Melting Furnace.—The steady growth in favor of electric furnaces for use in brass foundries is evidenced by the announcement that the Ohio Brass Company has signed contracts for the installation of these furnaces in its Mansfield (Ohio) foundry. The first unit will be a General Electric furnace with a capacity of a ton of molten metal an hour and a maximum demand of 400 kw. This furnace will replace oil-fired equipment.

New Interconnected Line in Indiana.—The high-tension line recently built by the Interstate Public Service Company between Seymour and Williams, Ind., to furnish power for a large territory in southern central Indiana has been placed in service. It will be energized by the generating station at Williams and will be connected at Seymour with the transmission line between Indianapolis and Seymour, which has been in service for a number of months.

Enlarging the Rate-Fixing Powers of Public Service Commission.—By the provisions of a proposed amendment to the state constitution now before the Virginia Legislature power would be given to the Corporation Commission of that state to increase the rates charged by public utilities even in cases where maximum and minimum rates have been fixed by franchises granted by cities and towns. Amendments to the constitution have to be approved by two successive legislatures and then be submitted to popular vote.

Ringing Ships' Alarm Bells by Wireless.—According to the American Chamber of Commerce in London, a wireless "calling" device has been perfected by which ships in distress can ring alarm bells on other ships within wireless range even though the operators on these ships are off duty. The invention comprises a special automatic transmitter key on the sending ship and a corresponding selective receiver relay on the other boats. By its use a powerful bell starts ringing on the ships called a few seconds after the key at the calling station is pressed.

Electric Supply in the United Kingdom.—In the inaugural address of Sir Charles A. Parsons, president of the British Association for the Advancement of Science, the rapidly increasing use of electricity was alluded to at length. At the end of last year, the speaker asserted, the central electric stations in Great Britain and Ireland contained plant aggregating 2,750,000 kw., 79 per cent of which was driven by steam turbines. The part played by the number, location and size of generating stations, by the power factor and by the extent of networks in bringing about cheap electricity were dwelt upon.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Pennsylvania State Association of Electrical Contractors and Dealers.—The annual meeting of this association has been postponed and will be held on or about March 10 in Erie.

Pennsylvania Electric Association, Central Section. — The Pennsylvania Hotel, Harrisburg, will be the meeting place of the Central Section of the Pennsylvania Electric Association on Wednesday, Feb. 25.

New York State Association of Electrical Contractors and Dealers.—At a meeting of the executive committee of this association at Syracuse M. H. Johnson of Utica was elected chairman, James F. Burns of Schenectady treasurer and J. P. Ryan of New York secretary.

New York Electrical Society.—This society will meet Feb. 26 in the Engineering Societies Building. Robert F. Gowen will read a paper on "Some Long-Distance Radio-Telephone Tests," and Charles A. Eaton will talk on "The Electrical Side of the Great Industrial Unrest."

A. I. and S. E. E., Birmingham Section.—The Birmingham (Ala.) Section of the Association of Iron and Steel Electrical Engineers will hold a meeting on March 13 to be devoted to "general ideas and discussions." Every active member is invited to prepare a paper on a subject pertaining to the application of electricity in the iron and steel industry.

Chicago Electrical Contractors Elect Officers.—The Electrical Contractors' Association of Chicago has elected officers for the ensuing year as follows: President, J. Norman Pierce; treasurer, J. O. Kelso; assistant treasurer, O. F. Burnett; secretary, J. W. Collins; assistant secretary, A. H. McGrew; executive committee: J. Norman Pierce (chairman), W. A. Jackson, L. H. Lamont, L. D. Gray, F. S. Leasure, A. Wagner and Tom Meade.

Annual Banquet of Engineers at Boston March 30.—All branches of the engineering profession will be represented at the eleventh annual banquet of engineers at the City Club, Boston, on the evening of March 30. The speakers will include the presidents of the national engineering societies: Paul D. Cravath, of New York, who will discuss "Economic Relations of the Peace Treaty," and Dean Roscoe Pound of the Harvard Law School. Irving E. Moultrop, chairman of the Boston Section of the A. I. E. E., will preside. Prof. Dugald C. Jackson is chairman of the general committee.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Assumption of Risk.—In action for damages because of fatal accident to employee, assumption of risk is no defense under the labor law where the preliminary notice is adequate, according to the Court of Appeals of New York. (125 N. E. 511; 227 N. Y. 345.)

Eminent Domain.—The erection of a wall in the bed of a river by the state on lands owned by it is not, the Supreme Court of the State of New York holds, an appropriation or use of the property of a company on the other side of the river, although the wall has narrowed the channel and at certain seasons so checks the flow of the river as to set back water in the company's tailrace and on its waterwheels. (179 N. Y. S. 294.)

Rights of Appropriator of Water of Stream.—When appropriation of water of a stream is made, the rights of the appropriator, it is held by the Supreme Court of Montana, are limited to the natural condition of the stream at the time and are not enlarged by subsequent improvements made by another which increase the supply flowing in the stream, and if such other person himself increases the available supply, he has a prior right to use it to the extent of the increase, but the increase must constitute a new or independent source of supply. (185 P. 1112.)

Fatal Accident to Employee Not Arising from His Employment.—Where an employee, while going from a telephone to the room where he was employed, stopped to talk with a fellow workman on matters unconnected with the employment and leaned on an iron table, taking hold of an electric lamp to enable him to look into a tank, from a motive of curiosity, his consequent death from electric shock was not, in the judgment of the Supreme Judicial Court of Massachusetts, an accident arising out of or in the course of his employment, entitling his dependents to compensation. (125 N. E. 565.)

Rehearings Before Public Utilities Commission.—Under Section 67 of the public utilities act, a rehearing before the Public Utilities Commission of Illinois can be asked at any time within the thirty days allowed for appeal, according to a decision of the Supreme Court of that state. Where the commission grants an unrestricted rehearing the whole case comes up for consideration as though no judgment had ever been entered, in which event the thirty-day limitation for appeal begins to run when the final order is entered after the rehearing and not at the date of the original order. (125 N. E. 495.)

Jurisdiction of Public Service Commissions Over Wholesale Rates Upheld.—The United States Supreme Court has handed down a decision in the case of the Napa Valley Electric Company vs. the California Railroad upholding the power of the commission over the wholesale rates of public utility companies. This decision establishes a precedent for commissions in all the states, the case having been recognized as a test of their authority in this matter. The suit arose when, on the application of the California Light & Telephone Company, the commission fixed the rate for the wholesale energy supplied to the telephone company by the Napa Valley company and the latter company denied the commission's jurisdiction. The decision confirms that of the state court.

Master's Negligence and Servant's Assumed Risk.—The Supreme Court of North Carolina has laid down the following principles in cases involving injury to an employee: The duty of a master to provide reasonably safe appliances and a safe place in which to work is absolute and cannot be delegated to another without incurring risk for the neglect of such other; it is the master's duty when he discovers a danger of which the servant is ignorant to warn him of it; a servant assumes the risks arising from the master's negligence if he knows of the defect from which they arise and appreciates the dangers; if negligence of master concurs with that of the servant in causing an injury, the master is liable; in action for injuries testimony regarding subsequent repairs was admissible in corroboration of evidence that defect existed. (101 S. E. 498, 518.)

Powers of Public Service Commission.—The Supreme Court of Nevada, in maintaining the constitutionality of the Public Service Commission law of that state, has declared (1) that though the commission cannot dispense with the essential rules of evidence which conduce to a fair and impartial hearing on the question of rates, it has liberal discretion in passing upon the competency of evidence; (2) that, the law providing that all rates fixed by the commission shall be deemed in full force and effect until final determination, the district court had no right to grant an injunction *pendente lite* restraining their enforcement; (3) that the courts cannot interfere with the commission or review its determinations further than to keep it within the law and protect the constitutional rights of the utilities; (4) that the section of the law providing that rates fixed by the commission shall remain in force until final determination by the courts having jurisdiction does not require that rates remain in force until final determination in the Supreme Court but only pending final determination by district courts; (5) that the district courts' jurisdiction is confined to passing upon the reasonableness of the charge, the court having no right to itself establish a rate. (185 P. 801.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

"Readiness-to-Serve" Charge.—"It is a popular error," the Pennsylvania Public Service Commission declared in a case against a gas company, "to say that a 'readiness-to-serve' charge requires consumers to pay for that which they do not receive. This is a wholly fallacious conception. Such charges are based upon the fact that the plant must be kept in a condition to render immediate service to each of its patrons whether he draws upon it or not. It costs the company money to be ready at all times to render such services. The real question which confronts the public and the commission is not with respect to the legality of such charges, but whether there be reasonableness in amount under the testimony."

Rural Telephone Service.—Among decisions handed down by the Missouri Public Service Commission affecting telephone service in small communities and rural districts in that state are these: An estimated value of $74 a station for 183 subscribers is excessive, but $50 a station is reasonable; an income of 11.8 per cent for return and depreciation on property valued at $10,650 is approved; the fact that subscribers have enjoyed free service with a nearby town does not necessarily justify its continuance; charging the same rate for party-line residence service as for direct-line service is discriminatory; a monthly charge of 50 cents for class A rural service, the subscriber owning and maintaining the line and equipment, is reasonable; increased rates for service permitting a net income of $23.42 on property of not less than $1,000 in value approved.

Proper Basis for Capitalization.—In a petition for consent to the transfer of the franchise, works and system of an electric plant in Madison County to the Solsville Electric Light & Power Company, the Public Service Commission of the State of New York, Second District, authorized a total capitalization of $30,000 notwithstanding that the price paid for the plant was only $20,000, it being shown that the present value of the plant, based upon the capital actually expended, less depreciation, was approximately the former sum. The commission held that as between a public utility and the public capitalization should be allowed to the extent of the investment less depreciation. As between the buyer and the seller of such utility the market price naturally measures the value. Where a question may be raised between buyer and seller because these valuations differ the court and not the Public Service Commission has jurisdiction.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

William Porter, formerly assistant engineer in the motive-power department of the Interborough Rapid Transit Company in New York City, has resigned to join the sales organization of the Electric Service Supplies Company at Philadelphia, Pa.

William S. Turner, consulting civil and electrical engineer of Portland, Ore., has recently returned from an extended trip throughout the East. His work in that section included valuation reports on various Pacific Coast properties, an effort to interest New York capital in developing a large hydro-electric power proposition in which he is interested, and a study of the electric railroad situation, especially as regards rates, franchises and motor-bus competition.

Major Harry H. Kluegel, formerly chief electrical engineer of the Mount Whitney Electric Company, who was engaged in camp construction in the West during the war, is now connected with the Walter Reed Hospital, Washington, D. C.

R. H. Bacon, who has been assistant electrical engineer for the Copper Range Company of Painesdale, Mich., since 1916, has joined the editorial staff of the ELECTRICAL WORLD. Prior to his connection with the Copper Range Company Mr. Bacon had been employed by the Eastern Michigan Power Company, by Woodmansee & Davidson, Chicago, by the L. K. Comstock Company of New York City and by other operating concerns.

H. L. H. Smith, an electrical engineer connected with the New England Power Company at Worcester, Mass., and previously on the staff of the Brooklyn Rapid Transit Company, is making a survey of one of the electric lighting systems in the West Indies, where electrical conditions and development are coming more and more under American direction.

Harold G. Paine, formerly principal assistant to N. J. Neall, Boston, has joined the engineering staff of Jackson & Moreland, Boston, following two years in government work. Mr. Paine was graduated from the University of Minnesota in 1906, electrical engineering course, and from 1906 to 1908 was employed in the engineering department of the Minneapolis General Electric Company. During this period he was in charge of field work in lightning protection on the Taylors Falls-Minneapolis transmission line and had other varied experience. For the next four years he was employed in the offices of D. C. & W. B. Jackson, Boston and Chicago. In 1913 he became associated with Mr. Neal and during this connection was occupied in designing, appraisal and other field work, including new plant electrical layouts for the Rumford Falls (Me.) Power Company and the Goodyear Rubber Company. Following the entry of the United States into the war, Mr. Paine was directly engaged in the design and supervision of electrical installations at Camp Devens, Mass., and the Camp Grant extension, later having in hand similar work at Camp Las Casas, Porto Rico. In the past year Mr. Paine has been on special work for the United States Shipping Board.

K. W. Adkins, engineer of the Missouri Inspection Bureau, Kansas City, Mo., was elected president of the Western Association of Electrical Inspectors at the recent annual meeting of the association in St. Louis. Mr. Adkins, who was born in Clay County, Mo., thirty-six years ago, attended the public schools and William Jewell College at Liberty, Mo. For five years after leaving college he was engaged in electric construction and operating work, but for the last fourteen years he has been engaged in fire prevention and fire protection engineering in his native state. He is also a member of the electrical committee of the National Fire Protection Association, the National Association of Electrical Inspectors, and the Underwriters' Uniformity Association, in all of which he has maintained an active interest.

K. W. ADKINS

C. M. Jansky, Jr., has recently been appointed an instructor in electrical engineering at the University of Minnesota, to specialize in radio and transient phenomena. Mr. Jansky is a graduate of the University of Wisconsin. He has had teaching experience in the army training schools and in the University of Wisconsin, following several months of research work on military intelligence problems at the Western Electric laboratories in New York City. He collaborated with his father, C. M. Jansky, in writing a textbook on radio-telegraphy. At the University of Minnesota his work will include courses with the Signal Corps unit and with other advanced students.

Thomas R. McAuley, manager of construction and operation of the Calgary (Alta.) Municipal Railway, has accepted the position of general manager of the New Brunswick Power Company, St. John, N. B.

Robert E. Barrett has been elected treasurer of the Holyoke (Mass.) Water Power Company, succeeding Albert A. Sickman, assistant treasurer and hydraulic engineer. Mr. Sickman had been serving as acting treasurer since the sudden death several months ago of Wallace E. Sawin, who had held the position of treasurer of the company for many years. Mr. Barrett has been connected with the Turners Falls Power & Electric Company for about a year, having charge of the erection of the power station of the company at Chicopee.

Obituary

John H. Manahan, formerly an engineer with Sargent & Lundy, Chicago, specializing in large power-plant construction, and a graduate of the Massachusetts Institute of Technology, Boston, in 1896, died recently at Boston. Mr. Manahan was active in electrical work for some years and also was employed by the American Stoker Company for a time. Of late he had devoted much attention to the invention and development of internal-combustion engines.

Walter J. Warder, Jr., chief engineer of Roth Brothers & Company, Chicago, died on Jan. 20, at his residence in that city. Mr. Warder was born Aug. 14, 1879, in Chicago. He was employed by the Western Electric Company for about four years, where he had experience in the testing and design of motors and generators. He then was employed by Roth Brothers & Company for about five years, during which time he designed a complete line of direct-current motors and generators. These machines are still being manufactured by the company. He left Roth Brothers & Company to broaden his experience and for a time was with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., the Adams & Westlake Company at Chicago and the Crocker-Wheeler Company at Ampere, N. J. He then left the electrical business to engage with the Tampa Steam Ways Company at Tampa, Fla., in shipbuilding, being interested also in the automobile business there. About three years ago he returned to the electrical business with Roth Brothers & Company as chief engineer in electrical and mechanical design. During the past few years he had been particularly interested in the development of a line of plating generators.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Jobbers' Costs Slightly Reduced on Increased Volume of Business

STATISTICS compiled by the central division of the Electrical Supply Jobbers' Association show that, even with the expansion of the volume of business during 1919 over 1918, the cost of doing business fell off only very slightly. Of the seventeen jobbers reporting, thirteen show a slight decrease in the per centage cost of doing business of from one-quarter of one per cent to 4 per cent, while four of those reporting actually show an increase. Inefficient warehouse help, increased cost of labor, rentals, increased cost of insurance and various other items are said to be the accountable factors, offsetting the increase of business volume as high as 150 per cent. The extreme variations in the cost of doing business are accounted for by the difference in specialization. One jobber, for instance, may handle supplies requiring more warehouse space and more help to handle heavy supplies than another whose volume of business of a different class is fully as great but may be done at a smaller percentage of cost. The following table shows the per centage of increase of volume of business, of the seventeen jobbers who reported together with a comparison of the per centage of operating costs for the years 1918 and 1919:

Member No.	Percentage of Increase—1909 Over 1918 Volume	Percentage of Operating Expense 1919	1918
1	50	18.3	19
2	150	16	17.7
3*	106	13.4	17.4
4*	55.5	15.6	16.2
5*	5	17.3	17.7
6	68.8	14.4	16.8
7	7.4	24.6	18.7
8	42	16.7	20.2
9*	35	15	18
10	48.6	13.5	11.2
11	60	19	20
12	38.8	14.25	12.6
13	28.2	18.7	19.9
14	20.8	19.21	18.62
15	63.2	15	15.84
16†	50	13.75	16
17	59	17.75	18

Salaries of executives, bonuses and commissions are included in all cases, except those marked *, which exclude bonuses and commissions, and that marked †, which excludes bonus.

No Profit in Distribution of Heating Devices, Jobbers Declare

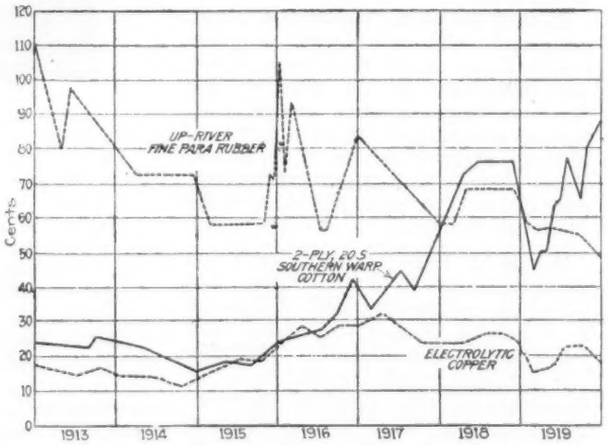
THERE is considerable discussion among the trade as to whether or not the distribution of electrical heating devices is a profitable business for supply jobbers. Under the present method of distribution there are several prominent Eastern jobbers who say it is not profitable. What is more, at least two manufacturers declare the production of this material is not profitable, and retailers say they cannot make expenses on their sales. The one exception to this pessimistic view is the so-called jobber who sells at retail. Here, it is said, the differential between jobber's cost and retailer's cost is sufficient to carry over a profit on the handling of the heating devices where in the case of either the jobber or the retailer the profit is declared to be insufficient to overcome the cost of handling the goods and leave a net balance.

One reason for this situation is the small units in which heating appliances are distributed. A prominent Eastern jobber has stated that during last June his average order was under $10, and that for 1919 his orders averaged $24. A factor instrumental in raising this figure to $24 was the unit packing method inaugurated last spring by one manufacturer. Too many small orders are being booked today by distributers. From one source comes the announcement that 80 per cent of orders are under $10 and that 88 per cent are for less than six devices.

In order to place the sale of these devices on a more satisfactory basis, one method which has been suggested is to segregate absolutely the jobber and the retailer. The jobber performs a very necessary service for the manufacturer in wholesaling his stock and distributing his goods, and for this service he should be paid a sufficient amount to leave a fair net balance over his costs. The retailer likewise renders a definite service and as such should be paid a sum sufficient to attract him to handle the goods. One jobber has suggested that the distribution of heating devices be placed on a basis similar to that of the distribution of lamps, and he believes that they will be purchased by the public in a few years in the same way the public buys lamps today. The trade already feels that the retail price is all that the consumer is willing to pay.

Fixed Bases Have Little Meaning in Code Wire Quotations

THE widely varying prices of the different materials entering into the make-up of insulated copper wire are making it more and more difficult to judge the price of any size of code wire from a given base price for that kind of wire. As a matter of fact, insulated-wire bases mean little in themselves today. Rubber-covered wire is now quoted on bases varying from 23 to 30 cents, the average being just under 28 cents. This means little



TREND OF PRICES ON UP-RIVER FINE PARA RUBBER, TWO-PLY, 20S, SOUTHERN WARP COTTON AND ELECTROLYTIC COPPER

to a wire customer who may be interested in sizes other than No. 14, as manufacturers say No. 14 is the size on which rubber-covered wire is based. Discounts, changing as labor and material costs change, allow for the difference in price of the various sizes of code wire.

At one time the cost of code wire was largely dependent upon the cost of bare copper wire. Labor, rubber, cotton, compounds, etc., were changing little in value. Consequently a single base could be used advantageously. Since the end of 1915 rubber has been decreasing in value, cotton warp has been increasing and copper has been fluctuating, but within rather small limits. During 1919 up-river fine Para rubber went from a high of 64 cents a pound to a low of 48 cents and is still decreasing, present quotation being 45 cents. In the same period two-ply, 20S Southern

warp cotton, starting at 66 cents, went to a low value of 44 cents, then rose to 87 cents, and is still rising. The present quotation is 95 to 98 cents a pound. Electrolytic copper in 1919 varied between the limits of 14.50 cents and 23.50 to 24 cents a pound and is now approximately 19 cents. Bare copper wire closely follows fluctuations in the raw copper costs. Consequently in the last year the cost of cotton has been playing a very important part, as well as the steadily increasing cost of labor. Cotton plays a larger part in small sizes of code wire than in large sizes, while copper is of more importance in the larger sizes. Labor plays a more important part in the smaller sizes.

At least two manufacturers of code wire are basing their quotations on net prices derived from the cost of each size of wire. This method appears to point out a way of arriving more closely at wire prices when the costs of materials other than copper are changing so widely in an article in the various sizes of which these materials enter to such disproportionate amounts.

The attached curves have been made up from curves received from the *Textile World Journal* and from the *India Rubber World*, and give the trend of prices of up-river fine Para rubber and of two-ply, 20S Southern warp cotton, in connection with electrolytic copper. The 20S size of two-ply warp is widely used, along with sizes up to 30S, in rubber-covered wire insulations and has been taken because it is representative. The different sizes of cotton, however, vary in price as demand and supply change.

Five Largest European Lamp Companies Form Two New Combinations

SOME interesting competition in the export lamp market may be expected shortly. For five years United States and Holland have had the world's markets for incandescent lamps largely to themselves. Germany, once a powerful factor in this line, is making arrangements for a "comeback," by a consolidation of her lamp-production. At the same time, the most powerful lamp interests in England and Holland have pooled operations.

The Osvam Works, Ltd., is the name of a new electric lamp manufacturing company, capitalized at 30,000,000 marks, which has just been organized in Germany, taking over the lamp factories of the German General Electric works, The Siemens-Halske and The Auer incandescent lamp works. This report has just been received by cable and shows the outcome of the amalgamation of these companies which was proposed last fall and was reported on page 1041 of the Nov. 29 and Dec. 6, 1919, issue of the ELECTRICAL WORLD.

At the same time comes the report of the amalgamation of the British and Dutch incandescent lamp companies, the Edison Swan Electric Company, Ltd., and the Philips Incandescent Lamp Works. G. L. F. Philips and A. F. Philips will join the British company's board of directors, it is stated.

Advances in Yarns Cause Rise in Cotton Electrical Goods

COTTON electrical materials have again advanced in price. Flexible non-metallic conduit prices are about 10 per cent higher than they were a week ago. Price at time of shipment is rather generally ruling. Prices on tapes and webbings, which had been withdrawn, were greatly increased in varying amounts last week. Varnished-cambric tapes and cloth advanced about 10 per cent. Friction tape has been advancing more or less sporadically, with the common grades of splicing tape quoted around 45 and 50 cents a pound.

The spot-cotton market slumped early in February, but started to recover at the end of last week and at this writing is at 38.45 cents. The yarn and fabric market has been rising for several months. Inability to secure sufficient labor in the process work of making the semi-finished products in the face of the heavy demand is given as the cause for the continued increases in price of these materials.

Loom manufacturers are booked up for many months ahead, and their policy of price at time of shipment shows the uncertainty of the cotton-yarn market for the coming months. Orders for varnished cotton insulating tapes and cloths are extremely heavy, but they are for rather short delivery. The buying seems to be much of the hand-to-mouth variety rather than for long shipments, showing an expectation on the part of the users of a drop in the market. There is a light shortage of the finer yarns for use in making the thinner grades of varnished cloth, namely, those of 5-mil and 6-mil thickness.

Lamp Agents Say They Are Unable to Make Six Turnovers a Year

PROTESTS have been coming in from lamp agents against the tungsten lamp manufacturers whose new contracts require a turnover of lamp stocks six times a year. The B agents feel that they cannot make six turnovers a year, especially under present conditions of lamp production and of transportation, when it is difficult to get prompt shipments. Some orders of two and three months' standing have not yet been received, among which are some for bowl-frosted and round lamps.

Under conditions holding today, the B agents feel that a turnover four times a year is a very fair rate, and several prominent Eastern B agents have given that as the maximum obtaining. Even three would not be considered excessively low, it seems. In order to keep the detailed accounts, B agents must of necessity spend considerable time and money, and they feel that the end is not justifying the means. Jobbers state that if the lamp manufacturers are willing to pay for this detailed accounting system, some attempt could be made to approach more nearly the rate of six turnovers.

The important feature of the new rider is the statement of the manufacturers that it is not a cut-and-dried contract, but that they are of an open mind on the subject and ready to entertain any suggestions on the part of the B agents in an endeavor to better it. Not all of these agents have signed the rider, but some have attached their signatures with a feeling that it is not all that it should be.

High Plane of Used Apparatus Market Attracting Many Sales

THERE is little doubt that the used electrical machinery market has come through the war and the first year of reconstruction in such a condition as to place it on a much higher plane than it previously occupied. It is necessary that a business become better as it lives, if it is to live at all. During the war there was sufficient attraction in this market to draw many new members into it; this had a tendency to localization of the market. These ranks were later depleted, however, and dealers are not now all of the opinion that the market has remained localized. In fact, some of them state that they are doing a broadly distributed business.

There is, of course, some direct selling of apparatus, but for the most part the dealer handles the transactions. The condition of the market today is such that all machinery must be in first-class condition. The dealers feel that in order to keep the business on a high plane the apparatus must be thoroughly tested and renovated, embracing a distinct service. One-year guarantees are almost general on second-hand motors. From this follows the necessity of shunning the promiscuous equipment because much of it the dealer of today would not care to guarantee. Only material which is readily salable at a reasonable profit is being handled.

The class of trade which the used apparatus dealer is now reaching, is, in the opinion of a representative dealer, one which before the war was unwilling to consider the possibilities of this market. From another source comes the statement that an enormous demand now exists from industrial concerns whose ordinary requirements were crippled during the war because of the inability to get ma-

chinery. There has always been a demand from some utilities and industrials for turbo units in excess of 2,000 kw., but the supply of units of this size is very limited and is said to be short of the demand. Deliveries of large units from manufacturers is now so long that little difficulty is being experienced in placing used equipment of high-grade manufacture whenever it can be found.

Units of about 500 kw. and under are in good demand for mines and industrials. Buyers are asking for high-efficiency prime movers, and machines are not easily sold which have been discarded because of high steam or fuel consumption. Many small boilers are changing hands, but the supply of larger sizes has not been equal to the demand. Dealers say that motor sales are increasing, and that no exception is made for large sizes. Capacities up to 250 hp., especially for alternating current, are moving in very satisfactory volume. The opinion is that there is much business on paper which will be placed as soon as present economic conditions are straightened out. The usual dealer's supply of fractional motors is far below present demand.

Metal Market Situation

Copper is moving at an extremely slow rate for domestic purchasers. Recent buying has taken care of virtually all of the first quarter and a part of the second. Purchases for the first period were in large quantities, and it is expected that consumption for the second period will be as large as, if not larger than, that of the first.

Producers evidently believe in the present market, for they are still holding to their price of 19 to 19.12½ cents a pound for February and March delivery. The outside market cannot even scare up any appreciable sales at a half cent under the producers' price. The latter's quotations for second-quarter delivery are 19.25 cents, while the outside market is quoted at 18.75 to 19 cents a pound.

There have been a few sales for export within the past week, and this has had a stabilizing effect upon the market. The advance in sterling permitted the making of these sales on a little more favorable basis for the buyer. This is the one metal that Europe cannot produce; it is essential to her industries and there is no substitute for it. She can, however, continue on a minimum quantity while the exchange situation is so unfavorable to her purchases abroad, but even rather small benefits through rising exchange are likely to open the way for greatly increased buying of the red metal.

Zinc reacted to a firmer market because of the advance in exchange last week. The domestic market is quiet, and inquiries are for prompt and nearby shipment, long shipments being considered in a less favorable attitude.

There is little spot lead available, although there is some in transit which is being bought whenever offered.

Aluminum has dropped one-half cent and is now quoted at from 31 to 32 cents a pound.

Scrap coppers and brasses are a fraction lower, while heavy lead is three-eighths of a cent higher under a somewhat heavier demand. The scrap market in general, however, is very quiet.

NEW YORK METAL MARKET PRICES

	Feb. 9	Feb. 16
	£ s d	£ s d
Copper		
London, standard spot	121 15 0	118 5 0
	Cents per Pound	Cents per Pound
Prime Lake	19.00	19.00
Electrolytic	18.50 to 18.62½	18.50
Casting	18.00	18.00
Wire base	22.25	22.25
Lead, trust price	8.75	8.75
Antimony	11.50	11.62½
Nickel, ingot	43.00	43.00
Sheet zinc, f. o. b. smelter	12.50	12.50
Spelter, spot	9.00 to 9.10	9.05 to 9.15
Tin	58.00	59.75
Aluminum, 98 to 99 per cent	31.50 to 32.50	31.00 to 32.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	17.00 to 17.50	16.50 to 17.00
Brass, heavy	10.00 to 10.50	9.50 to 10.00
Brass, light	9.00 to 9.50	8.75 to 9.00
Lead, heavy	6 87½ to 7.12½	7.25 to 7.37½
Zinc, old scrap	5.00 to 5.12½	5.00 to 5.12½

THE WEEK
IN TRADE

CONTINUED cold weather and depth of snow are keeping down the high rate of electrical business encountered in January. Temporary stoppage of actual construction relieves to some extent local delivery situations which at best are now very poor. Railway embargoes in the East are keeping raw materials from manufacturers and piling up finished products in their warehouses. The South is immune from bad weather conditions but is short of material. The San Francisco territory faces a very acute water shortage for irrigation purposes, which is already having some little effect on electrical sales. Building plans are maturing well in all sections. Collections are being closely watched.

Shortages are felt in general in wiring materials, except wire, and socket devices. All classes of cords are short. Porcelain and slate parts for switch and cut-out bases are locally hard to get. Absence of spot lead and long-time shipments are lengthening shipments of power and other lead-covered cables, demand for which is heavy.

There is a good demand for lamps, socket appliances, wiring materials of all kinds, tape and motors, and local demands call for sewing machines, line materials, heavy-duty cooking devices, refrigerators and industrial trucks. Price advances were reflected in loom, metal molding, turbines, Edison storage batteries and one make of vacuum cleaner.

NEW YORK

Transportation facilities in New York City have been almost completely tied up since the storm. Embargoes are still holding up freight and arrivals of electrical material in the city have been light. Consequently stacks of steel products in particular are low. The influenza is on the wane, and sales and clerical forces are in a little better shape. Building has not recovered, however, and cannot do so until material can be moved and the weather moderates. Building plans, on the other hand, are going ahead in a good way, and hardly a day passes without the announcement of several new structures, each one in seven figures. Home developments are also working out.

Price advances have been announced on turbines, alkali storage batteries, loom, cotton insulation and metal molding. Jobbers are tightening up a bit on collections.

Flexible Armored Conductor.—Price advances of two weeks ago are buying jobbers' quotations up to $95 and $96 for 1,000 ft. of No. 14 double strips.

Rigid Conduit.—Some jobbers with small stocks are quoting $76 for 1,000 ft. of ½-in. black pipe. Others, depending on manufacturers' stocks, are quoting $108. Supply is very limited.

Non-Metallic Flexible Conduit.—A price advance of 10 per cent was effective last week. Bookings are very heavy and supply is light.

Metal Molding.—A 10 per cent advance went into effect a week ago. There is little available and the demand is heavy. Fittings were similarly affected.

Power Cable.—The utilities are ordering heavily for spring work. Lead is short and deliveries are around three months.

Lamp Cord.—The market is getting tighter and prices are $22 to $23 per 1,000 ft. for No. 18 twisted cord. The shortage is general.

Heater Cord.—The heavy winter has held up mining of asbestos, and the shortage of this material is reflected in the small quantities of heater cord available. Demand is heavy. Better supply is expected in the spring.

Silk Cord.—Shortage of silk thread is leading to a sub-

stitution of artificial silk for cords. The former silk cord has virtually disappeared from the market.

Heaters.—Sales have been good, and some jobbers with almost no stocks have decided to call it a season and not order any more.

Varnished-Silk Insulation.—A small quantity of silk is available to cope with a heavy demand for tape and cloth. Prices are stable.

Turbines.—Prices on the entire range of Westinghouse turbines have been advanced. Quotations in before Feb. 6 will be protected until March 1.

Storage Batteries.—Prices on all types of Edison batteries will advance approximately 10 per cent on March 1, but quotations in prior to March 6 will be protected.

Wire.—Stocks in general are ample, although jobbers are short on a size here and there. Mill deliveries are good. Prices are steady at about $12.50 for 1,000 ft. of No. 14.

BOSTON

Orders are holding up well. Jobbers' stocks are depleted in appliances and some kinds of wiring material. Deliveries are confirmed chiefly to local express and parcel post shipments from distributers' warehouses, the flow of incoming freight having been sharply curtailed by adverse weather and railroad embargoes. Collections are rather poor for the time being. Prices hold firm in the main, with stiffer quotations in loom and a representative make of vacuum cleaner. Building operations under contract to Feb. 12 in New England total $22,030,000, compared with $6,483,000 in the same period of 1919 and $10,559,000 in 1918. A 66,000-volt transmission line will shortly be built in Connecticut to connect the Connecticut Power-Hartford Electric Light systems with the New London-Norwich district. A five million dollar hotel is planned for Providence, R. I., and banking and insurance structures for Boston, totaling $7,000,000, are on the latest lists of new work. Business in interior New England has been greatly handicapped by stormy weather, and central stations out of reach of tidewater coal are running close to the edge of a famine. Retail electrical sales are feeling the effect of bad weather.

Wire.—Prices are steady, rubber-covered being quoted around 30 cents base, weatherproof at 29 to 30 cents, and bare at 24 cents. Water shipments are coming through fairly well. The demand is easier for the moment.

Dry Cells.—Some overstocks of ignition batteries are reported, despite a fair demand. No. 6 cells bring $32.90 per 100 in barrel lots, with $33.90 for igniters.

Flexible Armored Conductor.—Prices are stiff, $95 per 1,000 ft. being quoted on No. 14 single-strip in coil to 1,000 ft. lots. Small quantities bring $100. Here and there fair stocks are reported, but nothing like a fat surplus can be located.

Non-metallic Flexible Conduit.—Prices are up, the $\frac{3}{8}$-in. size bringing $37 per 1,000 ft. in coil to 1,000-ft. lots, and the $\frac{1}{2}$-in. size $40. Jobbers are oversold on this material for months ahead.

Tubes.—A severe shortage exists, some bins being empty. Nominal quotations run around $9 per 1,000 for standard packages.

Nail-it Knobs.—These bring $28 per 1,000 in barrel lots, but the scarcity of nails is holding up shipments.

Sockets.—Pulls, 65 cents; keys, 29 cents, and keyless, 27 cents, were quoted Monday. Shipments from the factories are improving materially, and if the railroad embargoes end soon, customer's requirements will be met comfortably for the time. Manufacturers report increasing business from all parts of the country, and labor conditions are somewhat better.

Lamps.—The usual January slump in orders did not materialize, and manufacturers are obliged to ship orders on the installment plan again. Deliveries are hampered by snow.

Vacuum Cleaners.—Business is very brisk. A price advance from $49.75 to $55 at retail, following a factory increase, went into effect on Torrington cleaners Feb. 15.

Refrigerating Equipment.—An active demand is noted. "Automatic" equipment has advanced in price 5 to 10 per cent. Piping is hard to get, but motor requirements have been well anticipated.

Appliances.—Stocks of hollow ware are running low, and shipments are considerably disturbed by railroad conditions. Portable lamps are moving well at reduced rates.

Molded Insulation.—An enormous demand is being encountered. Factory stocks are negligible, and prices are firm.

CHICAGO

The volume of business being done by Middle West jobbers seems to be limited only by their inability to keep up stocks. Practically all stocks are spotty, one jobber having a fairly good line of certain goods while another will be practically cleaned out in the same line. Shortages are greatest in iron conduit, outlet and switch boxes, and metallic armored conductor. The sewing-machine business continues in large volume with the cabinet type coming along stronger. The opening up of the spring business in weatherproof wire is expected shortly and stocks are being acquired in anticipation of this business. Inquiries are already being received for line materials for construction work that will begin as soon as weather conditions are more favorable. House wiring is proceeding in certain localities at an unusual rate. In some mining sections such as northern Michigan hundreds of houses are being wired by the mining companies in order to better living conditions, with a view to holding labor. The selling of heating appliances on the partial-payment plan is increasing after the holidays. Jobbers state that one of the peculiar trade conditions has been that the greater part of the holiday business was on a cash basis. Building permits issued in Chicago for the week ended Feb. 14 amounted to $3,300,000, with $2,000,000 of this in an apartment hotel. Kansas City is to have a consolidated interurban station to cost $1,750,000.

Wire.—Stocks of both rubber-covered and weatherproof are in fairly good shape. No. 14 rubber-covered is quoted at $12.50 per 1,000 ft. in 5,000 ft. lots and $11.25 to $11.75 per 1,000 ft. in 10,000-ft. lots.

Sockets.—New prices on sockets after last week's increase are as follows: $\frac{1}{4}$-in. key sockets, $28.05 per 100 in standard packages of 500, $33 per 100 for one-fifth standard package and $37.95 per 100 for less than one-fifth package; keyless sockets at $25.50 per 100 for standard package, $30 per 100 for one-fifth package and $34.50 per 100 for less than one-fifth package; pull sockets at $51 per 100 for standard package of 250, $60 per 100 for one-fifth standard package, and $69 per 100 for less than one-fifth package.

Snap Switches.—Stocks are fair with new prices as follows: 5-amp. single-pole non-indicating switch is quoted at $23.80 per 100 in standard packages of 250, one-fifth package at $28 per 100, and less than one-fifth standard package at $32.20. Three-way switches are quoted at $40.80 per 100 in standard packages of 100, $48 per 100 in one-fifth package lots, and $55.20 per 100 for less than one-fifth package.

Rosettes.—There is a considerable demand for concealed type rosettes for cheap house-wiring work. Stocks are somewhat spotty. Concealed rosettes are quoted at $12.75 per 100 in standard-package quantities of 250 and up to $17.25 per 100 for less than one-fifth standard package.

Lamp Cord.—No. 18 cotton-covered is stocked very poorly in some cases and is hard to obtain from manufacturers. It is quoted at $26 per 1,000 ft. in 500-ft. lots and at $24.25 per 1,000 ft. in lots of over 1,000 ft.

Conduit.—Stocks are very short with prices as a rule on basis of delivery. Where quotations can be made from stock, $\frac{1}{2}$-in. enameled is quoted as low as $73.10 for 1,000 ft., $\frac{3}{4}$-in. enameled at $96.60 for 1,000 ft. and 1-in. enameled on the same basis at $142.80.

Fiber Conduit.—Stocks are fairly good in fiber conduit. The socket joint 3-in. is quoted at $14 per 100 ft. and $13 on orders of $500 list.

Non-metallic Flexible Conduit.—A price advance of about 10 per cent was announced on Feb. 13. Stocks are very spotty.

Dry Batteries.—Stocks of dry cells are in fairly good shape. The regular No. 6 cell is quoted at 45 cents for less than 12, 38 cents on 12 to 50, 36¼ cents on 50 to 125, 33¼ cents on quantities over 125. The igniter cell runs above 1 cent higher and the telephone cell 3 cents higher.

Switch Boxes.—Stocks of sectional switch boxes are very low in some cases. Manufacturers are working mostly on the fast-moving boxes, and as a result certain types are hard to obtain.

Sewing Machine.—The sewing-machine business continues in excellent volume. An increasing number of cabinet-type machines are being sold as compared with the portable type. The Free Westinghouse is listed at $63 for the portable vibrating shuttle type and $100-$106 for the rotary shuttle cabinet type, depending on the cabinet finish. The Wilson is quoted at $72 for the portable type.

ATLANTA

Business activities continue to move at an unprecedented rate, and the prospects are that only the shortage of material will slow down operations. Building permits continue to increase, a large number of apartment houses and commercial buildings being under construction and projected. High prices on all materials have not served in any way to dampen these operations. Authorities announce that the value of the agricultural products of the South amounts to 44 per cent of the entire country's products and equals approximately ten billion dollars. This assures the continued supply of funds for the financing of all classes of building and expansion throughout the section. Difficulty is reported in obtaining materials, particularly lumber and those commodities dependent upon steel for their manufacture.

Jobbers report a growing popularity of all types of labor-saving devices, particularly washing machines, dishwashers, vacuum cleaners and the like.

Flexible Armored Conductors.—A price advance of approximately 4 per cent has been announced. An acute shortage exists because of poor shipments, which are now quoted at 90 days.

Wire.—Stocks throughout the section continue spotty, most firms quoting a shortage on the popular sizes of both rubber-covered and weatherproof, although there is a fair amount of the larger sizes available. Shipments are fair but are so quickly absorbed as to prevent the accumulation of stocks in Nos. 6, 8 and 10. Prices are steady, with rubber-covered at 28 cents base and weatherproof at 29 cents base.

Heating Devices.—Unusually strong demands continue, and contractors are placing orders for the 1920 holiday trade. The present supply does not equal the demand and little hope of improvement is held out because of slow shipments.

Friction Tape.—Despite the exceptionally high prices, an extraordinarily large demand is reported by the trade. Owing to good shipments, no difficulty is yet being experienced in supplying the demand. Prices are quoted, weatherproof, lots less than 5 lbs., 73 cents; 50 lb. to 25 lb., 62 cents; 25 lb. to 100 lb., 56 cents.

Automatic Refrigerating Units.—Manufacturing jobbers report an increasing demand for household refrigerating units. Sales are on the increase. Active sales campaigns are being outlined for the spring months.

Line Material.—All articles entering into line construction are moving briskly, owing to belated expansion by distributing systems throughout the section. One jobber reports the sale of approximately 1,000 poles in Florida alone within the past thirty days. The supply of line material is holding up well and shipments are fair.

Fans. — Jobbers are placing heavy orders for spring stocks, one of the most prominent having doubled the quantity of his order for 1919. Large sales are anticipated despite an expected increase in prices.

Washing Machines.—A tremendous demand continues in the face of the recent price advance, one jobber alone reporting the sales of 500 machines in the past thirty days. Shipments are slow, especially of the swing-wringer type.

SEATTLE—PORTLAND

Business activity in Seattle and the Puget Sound district as a whole shows very little improvement over the past two weeks. The movement to shipyards and industrials at present in negligible. However, a certain sales volume is maintained by the movement of domestic appliances and house-wiring devices, the latter showing a gradual increase. Jobbers' stocks as a whole are in good condition because of the light demand, although the shelves cannot be said to be overstocked. Building activity is general throughout the Northwest. Home building forms a large part of new construction. However, public and civic improvement is also quite widespread. The building material market is being swayed by the building activity, and prices, it is felt, will remain firm. So far as the Northwest is concerned, the outlook for the farmer is good.

In Portland, manufacturers' representatives state, prospective business is looking very good, and actual sales for the past week have been materially better than a year ago. The main difficulty is not a matter of obtaining business but rather of obtaining material from the East. Jobbers report that business has not been so good in the past week, but that prospects which will materialize in the near future are very satisfactory, and they feel that general business conditions will improve soon. Credits have to be watched very carefully at the present time, because a number of small contractors, former shipyard electricians, are starting in business. This condition, however, will be eliminated as soon as industrial conditions improve. Contractors report wiring for residences, commercial garages and industrial plants very active. Good labor is scarce.

SAN FRANCISCO

Only about one-quarter of the normal amount of rain has fallen and the draught situation is extremely serious. Strikes of telephone linemen and operators were rather unsuccessful. Several telephone offices have officially announced that no extensions will be made during 1920. It is reported that the government will soon commandeer water from some of the power lakes for irrigation purposes.

Ironing Machines.—The ironing machine business, which has been principally in the hands of department stores and special kitchen-furnishing stores, is rapidly passing over to a channel of distribution through electrical dealers, and several jobbers who have not hitherto pushed the line are placing carload orders.

Farm Plants.—It is unfortunate that just when farm plants began to be shipped from various Eastern factories dealers find that the water shortage interferes with their sales.

Household Devices. — Sales of washing machines and vacuum cleaners in the country districts have slowed down, although they are moving better than ever in the cities. It is found, however, that customers are more inclined to shop about and try several machines before deciding. Various strikes have hurt the business, for they have tied up regular time payments.

Ranges.—February has been a particularly active month for prospects of heavy-duty cooking material, such as ranges of 20 kw. and larger, big bake ovens and miscellaneous hotel cooking equipment. This demand is largely due to the checking and overhauling of equipment for the coming resort season and to advertising.

Schedule Material.—Domestic sockets, switches and the like have jumped 7½ per cent with comparatively few anticipating orders reported. Jobbers are asked to anticipate their year's requirements, however, so that the factories can be advised accordingly. Industrial inclosed switches, such as are demanded by state laws, have jumped 10 per cent. The biggest item ordered now is the double-throw switch for range and water heating. The jobbers are laying in good stock in expectation of the successful maturing of range campaigns.

Reflectors.—Window reflectors of several styles advanced about 10 per cent. Stocks are comparatively poor, being rather spotty. A good demand exists.

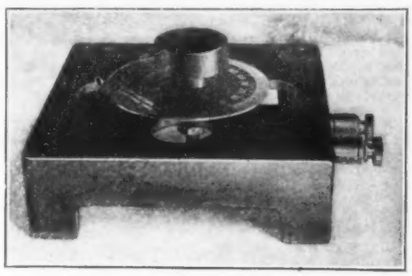
Weatherproof Wire.—The present price on base sizes in coil lots is 33 cents per lb. f.o.b. Pacific Coast points.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Rheostat for Wireless

A radio rheostat 4 in. square, to be used either on a table or screwed to the back of a panel, is being manufactured by the Clapp-Eastham Company, Cambridge, Mass. This rheostat is designed for providing a convenient variable resistance for wireless and



FOR USE ON TABLE OR MOUNTED ON PANEL

other work. The rotary handle moves from zero to maximum resistance through an angle of 120 deg. The rheostat may be either set on a table or screwed to the back of a switchboard panel with only the control handle and scale in front of the board. The complete instrument weighs 1½ lb. It is supplied in sizes ranging from 12.5 ohms maximum resistance with 3 amp. maximum to 1,000 ohms with 0.3 amp. maximum.

Cable Connector for Quick Work

For making quick connections to heavy-duty portable machines small motors, transformers, etc., where connections are made and broken frequently, the General Electric Company, Schenectady, N. Y., has developed a new cable connector. It is made to fit several standard sizes of wires and rated at 30 and 60 amp. and 250 volts. This connector consists of two molded compound halves with male and female hollow brass nipples for screwing the two halves together. The wires are soldered into sleeves with a solid end surface contact which slip through the threaded nipples, making connection when the two halves are screwed together.

Muffle-Type Heat-Treating Furnace

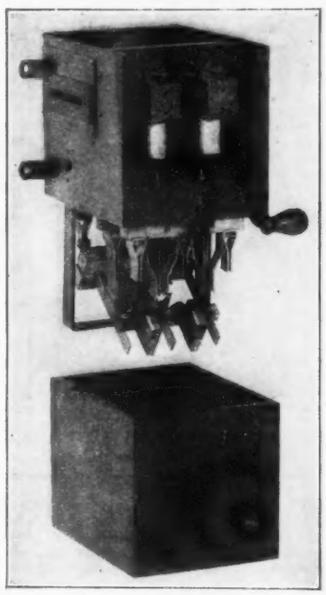
An electric furnace of the muffle type, which is designed by the General Electric Company to meet the demand for a durable, economical, compact and convenient furnace for temperatures up to 850 deg. C. for baking vitreous enamel, hardening and tempering tools, dies, etc., has been developed.

The heating element, which is mounted on the outside of the muffle and covered with compound, is in two parts, giving two degrees of heat. The muffle is mounted in a strong steel casing, and the walls, door, etc., are insulated.

The control panel, which is on top of the furnace, is equipped with a main-line switch, a double-throw switch for high or low heat and a red pilot lamp which acts as a warning to the operator when the furnace is on high heat. There are rheostat connections at the side for use when lower temperatures are desired.

Oil Switch for Star-Delta Control

An oil switch for star-delta motor control has been placed on the market by the Electrical Machinery Sales Com-

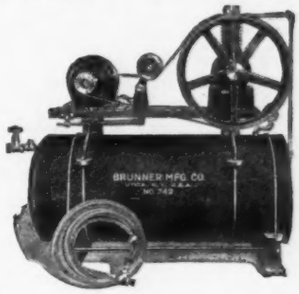


OIL TANK LOWERED

pany of Chicago, which is a development of the Carman & Fryer knife switch. Trip coils give protection against overloading the motor, and a no-voltage release throws the switch to the off position in case of service interruptions. A cover, which is not shown, fits over the top portion, inclosing all parts. It is claimed that the length of the contact jaws tends to prolong the life of the current-carrying parts, as the make and break points are clear of the current-carrying surfaces. In throwing the switch to the starting position the handle is thrown up and must be lowered slightly, releasing a catch, before it can be thrown higher up into the running position. The switch cannot be left in the starting position because of the provision of a spring which tends to throw it out.

Small and Noiseless Air Compressor

For use where the noise incident to gear drive would be objectionable, the belt-driven air compressor manufactured by the Brunner Manufacturing Company, Utica, N. Y., has been designed. The power plant consists of an air compressor with a capacity of

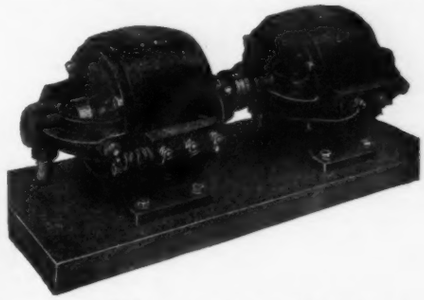


SMALL AND QUIET IN OPERATION

2½ cu.ft. of air per minute, belt-driven by a ½-hp. motor. A spring device is provided to maintain correct belt tension. The power plant is mounted on a cast-iron sub-base which is supported by the tank, and the entire outfit is 3 ft. long, 1½ ft. wide and about 3 ft. high. The air tank has a capacity of 32 gal. and is guaranteed for 150 lb. working pressure. The motor is furnished for either 110, 220 or 32 volts direct current and 110 or 220 volts, 60 cycles or 25 cycles, alternating current.

500-Volt Radio Motor-Generator

A 500-volt, 100-watt generator driven by a 110-volt motor makes up the set developed for radio purposes by the International Radio Telegraph Company, 326 Broadway, New York City. The generator is designed for use with 500-volt vacuum tubes and for other purposes requiring not over 0.3 amp. It is designed to carry 100 per cent overload for short periods. It has



GIVES 500 VOLTS FOR RADIO WORK

a forty-eight-bar commutator so as to produce a minimum "ripple" and gives quiet operation. Voltage variations are said to be slight since the generator is flat compound-wound. The set is supplied with either a direct-current or an alternating-current motor.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE GENERAL ELECTRIC COMPANY, Pittsfield, Mass., is arranging for the immediate erection of a new brick addition to its plant in the Morningside district. The structure will be about 100 ft. x 400 ft. and will be used as an extension to the enameling department.

THE AETNA ELECTRIC APPLIANCE COMPANY, Boston, is placing on the market a new electric water heater to be known under the trade name of "Hotvent." This heater was designed by Ralph J. Patterson, who has recently been appointed commercial manager of the Twin-State Gas & Electric Company, Boston, Mass.

THE STROMBERG ELECTRIC COMPANY has secured permit to build a five-hundred-thousand-dollar factory in Chicago, Ill.

THE ELECTRICAL REFRACTORIES COMPANY is the name under which the Novelty Clay Forming Company has operated since Jan. 1. The new company, reincorporated in Ohio, has purchased resently a large modern factory at East Palestine, Ohio, which will enable its capacity to be tripled. No change has been made in the organization or management.

SMALL POWER PLANTS FOR SALE BY GOVERNMENT.—Among the electrical equipment still on hand and that is being offered for sale by the Director of Sales are 400 new generator sets of a special design that were made for research work in the trenches and that are said to be readily adaptable for use by small towns and for small light and power plants. These sets are being offered for sale at a considerable reduction from their original cost.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, Mansfield, Ohio, has opened new headquarters in Philadelphia for negotiating and engineering purposes. The offices are in the Baxter Building, and D. M. Hilliard is in charge.

H. W. POWER has resigned as secretary of the White Lily Manufacturing Company, Davenport, Iowa, to become secretary-treasurer and general manager of the H. F. Brammer Manufacturing Company, Davenport, maker of "Grand Electric," "O. K. Electric" and "O. K. Bench Electric" washing machines. Mr. Power has been connected with the White Lily company for seventeen years.

THE ELASTICAP COMPANY, Hoboken, N. J., incorporated with a capital of $125,000, manufactures mechanical and electrical goods and devices, and particularly a patented rubber splice insulator known as "Elasticap," a device to replace the rubber elastic tape now used for end-splices in fixtures and outlet boxes. Elasticaps have been accepted after test by the Underwriters' Laboratories, Inc., as of Jan. 6, 1920.

THE ELECTRICAL ENGINEERS' EQUIPMENT COMPANY has opened a district sales office at 2611 Union Central Building, Cincinnati, Ohio. This office will be in charge of R. M. Heim, who for a number of years has been connected with the Chicago office of the Electrical Engineers' Equipment Company.

RALPH B. COLEMAN has been appointed sales manager of the Omaha Electrical Works, 1214 Harney Street, Omaha, Neb. This company handles motors, generators, engines, boilers, elevators, etc., and also does repair work. Mr. Coleman was formerly connected with the Electric Machinery Company of Minneapolis, and with the Moloney Electric Company as manager of its Chicago office.

THE DOMESTIC ELECTRIC CORPORATION, Atlanta, Ga., has been incorporated with a capital stock of $1,000,000, and will exclusively distribute the Delco Light products. F. K. Runyan, who will be president and general manager, for four years has had charge of distribution of the Delco Light products in Georgia and has been conducting the business as a direct branch of the Domestic Electric Company. The other officers of the company are A. M. Bergstone, vice-president, and Frank Jeter, secretary and treasurer.

THE PHELPS FARM LIGHT & POWER COMPANY has established Southeastern headquarters in Atlanta, Ga. Several salesmen will travel from the Atlanta office, and expert service men will be kept in this field by the company. The organization will cover the states of Georgia, Florida and Alabama. The Phelps company is one of the largest manufacturers in the Middle West of complete light and power systems for homes, stores, institutions and other users of light and power. The main factories are at Rock Island, Ill.

MACHINERY CENTER OPENED.—The Allied Machinery Company of America has recently opened at Center and Walker Streets, New York City, an exhibition of construction and industrial machinery of several kinds.

RAYMOND MARSH, who for the last four years has been secretary of the American Washing Machine Manufacturers' Association, Chicago, has resigned to become general sales and advertising manager and assistant to the president of the Syracuse (N. Y.) Washington Machine Corporation. Prior to his connection with the electrical

RAYMOND MARSH

industry Mr. Marsh was for four years assistant secretary of the Davenport (Iowa) Commercial Club and other business organizations in Davenport. During his connection with the Washing Machine Association the industry has grown from one which did $7,000,000 worth of business in 1912 to one which did $15,000,000 worth of business in 1919.

EASTERN FACTORY AND BRANCH FOR FRENCH FLASHLIGHTS AND DRY CELLS.—The growing demand in the East for French Ray-O-Lite flashers, Ray-O-Lite batteries and French dry cells, products of the French Battery & Carbon Company, Madison, Wis., has necessitated the establishment of a factory at Newark, N. J., and branch office at 71-73 Murray Street, New York City. All Eastern business of the French Battery & Carbon Company was taken care of by the New York branch on Jan. 1, 1920.

ERNEST V. PANNELL is now stationed in New York City as special sales engineer for the British Aluminium Company, Ltd. He was graduated from the Northampton Engineering College in London, England, in 1908, and after a few years' construction and testing experience joined the staff of the British Aluminium Company in 1911. He has since been associated with the various factories and rolling mills of the company and also with the commercial side, having for the last four years been manager of the Canadian head office in Toronto. Mr. Pannell is a member of the American Institute of Electrical Engineers.

THE APEX APPLIANCE COMPANY is adding $200,000 reconstruction to its Chicago factory.

THE STANDARD ELECTRIC & ELEVATOR COMPANY, INC., Baltimore, Md., has just opened a Philadelphia office at 1105 Finance Building, with C. G. Schafer as district manager. Mr. Schafer for the the past ten years has been sales and application engineer of the Westinghouse Electric & Manufacturing Company and has had a broad experience in the sale of equipment in the marine and industrial trade of the Philadelphia district.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces that, arrangements having expired under which the St. Paul Electric Company, St. Paul, Minn., has maintained stocks of Emerson and Northwind fans and Emerson motors at that point, the Northern Electric Company of Minneapolis will have available larger stocks of this apparatus than in past years. A carload of Emerson and Northwind fans is to be added to the Minneapolis stock of the Northern Electric Company for the season of 1920. Furthermore, a like arrangement with McCarthy Brothers & Ford, Buffalo, N. Y., having expired, a stock of Emerson and Northwind fans will be maintained at Buffalo during the season of 1920 by the Johnson-Wahle Electric Company, 222 Pearl Street.

STANDARD STEEL BEARINGS, INC., 347 Madison Avenue, New York City, which is owned and operated by the Marlin-Rockwell Corporation, has been organized to consolidate the plants of the Marlin-Rockler Bearing Company, Philadelphia, Pa., Braeburn Steel Company, Pittsburgh, Pa., Rockwell Drake Bearings Division, Plainville, Conn., Willow Street and Hawden Divisions, New Haven, Conn., and the Norwich Division, Norwich, Conn. The new organization was determined solely by considerations of efficiency, in view of the program of expansion necessitated by the growth of demand for the products named, according to a statement from the company. No change is implied either as to policy or executive and operating personnel.

THE ELECTRO SERVICE COMPANY, which some time ago acquired all the patent rights covering the Bennett surge arrester invented by C. E. Bennett, electrical engineer of the Georgia Railway & Power Company, is now manufacturing these arresters in several designs in a new plant established at Marietta, Ga. This type of arrester, which relieves surges due to lightning, switching disturbances, arcing grounds and the like, is being made for voltages from 2,300 to 110,000. It is now understood that two other types will soon be ready, one for 140,000 volts and the other for 1,500 volts direct-current railway service. G. N. Lemmon is general manager of the company in charge of production. The following sales representatives have been appointed: Maxwell Engineering & Manufacturing Company, 61 Broadway, New York City; Mill Power Supply Company, Charlotte, N. C., and E. A. Thornwell, 1026 Atlanta Trust Company Building, Atlanta, Ga. A new bulletin, known as No. 2C, which has just been issued, describes in detail the operation of the arrester and shows some of the actual installations of the device that have been made.

OIL BURNER EQUIPMENT PLANT STARTED AT STAMFORD, CONN.—The Petroleum Heat & Power Company, a reorganization of the Fess Rotary Oil Burner Company, Boston, Mass., has begun the erection of a factory on Stamford Harbor, Stamford, Conn., for the manufacture of oil burners and equipment for changing over steam plants from a coal-burning to an oil-burning basis. The company is capitalized at $2,000,000 and is backed by Boston and New York interests. The first factory building to be 200 ft long by 160 ft. wide. Ultimately it is anticipated that about 4,000 persons will be employed. The officers are: President, Col. F. Lorthrop Ames, Boston; vice-presidents, Robert Adamson, New York, and W. G. McTarnahan, Boston; treasurer, F. Murray Forbes, Boston. Others reported to be financially interested, include W. Cameron Forbes, Boston, former Governor-General of the Philippine Islands; George E. Cabot and Henry G. Lapham of Boston; W. C. Durant, president General Motors Corporation; Andrew Adie, Boston; Bradley W. Palmer and F. H. Prince, Boston; Louis G. L. Kaufman, New York, Henry R. Hoyt and Gen. Coleman du Pont, New York. The company informed a representative of the ELECTRICAL WORLD recently that special attention will be paid to equipment for the conversion of central stations from a coal-burning to an oil-burning basis.

Supply Jobbers' Notes

THE MOHAWK ELECTRICAL SUPPLY COMPANY, Syracuse, N. Y., announces the following changes in connection with the expansion of the sales department, made necessary by a greatly increased business and plans for the future. H. M. Sliter, for the past seven years manager of the Elmira district office of the General Electric Company, has been made sales manager, and J. J. McGuire of the sales department of the company has been made assistant sales manager.

C. C. McKIRAHAN has been appointed sales manager of the Central Electric Company, Chicago. After being graduated from Kansas State University Mr. McKirahan was in the electrical department of the Santa Fe Railroad until he joined the forces of the Central Electric Company seven years ago. He traveled in Kansas for this company until two years ago, when he was made manager of the engineering department, which position he held until his present appointment.

CHARLES SELZER has resigned as sales manager of the Central Electric Company, Chicago, to become sales manager for the B. R. Electric Company, Kansas City, Mo. Mr. Selzer was manager of the Chicago office of the Adams-Bagnall Company until he became connected with the Central Electric Company five years ago.

THOMAS N. MEHAN, who has been connected with the Electrical Appliance Company, Chicago, for eight years, has become a member of the sales organization of Paul W. Koch & Company, Chicago, and will handle local distribution of the "Jiffy" products and electrical specialties, which are being marketed by that company.

L. E. LE VEE, formerly sales manager of the Clemens Electrical Corporation, Buffalo, N. Y., is now the manager of the appliance department of the Robertson-Cataract Electric Company, Buffalo, N. Y. Mr. Le Vee was recently elected president of the Electric Club of Buffalo.

THE ELECTRICAL POWER & APPLIANCE COMPANY, Yakima, Wash., has been formed by Al Schroeder, C. H. Kirby, A. L. Fullbright et al. to represent the Western Electric Company. The concern will maintain a farm-lighting plant depot, and its territory includes the southwestern section of the state, with dealers in all towns to handle the Western Electric lines.

NEW SUPPLY DIVISION MANAGER FOR WESTINGHOUSE SEATTLE OFFICE.—On Jan. 1, 1920, the appointment of J. G. Miles as supply division manager of the Westinghouse Electric & Manufacturing Company's Seattle office became effective. Mr. Miles succeeeds C. V. Aspinwall, now the company's representative at Spokane, Wash. Mr. Miles has seen long service in the supply department of the company, serving for several years as the head of the insulation section at East Pittsburgh, Pa. His grasp of the details of supply work has been responsible for the upbuilding of a considerable portion of supply sales and also for the exploitation of many new products, some of the better known of which are the bakelite and bakelite micarta products, particularly as applied to insulation and gears.

Foreign Trade Notes

MINIMUM PRICES ON ELECTRIC LAMPS ESTABLISHED BY ITALY.—By a recent decree the Italian government has established minimum prices at which lamps can be sold. This supplements the decree as noted in these columns on Dec. 20, 1919, by which the so-called 25 per cent tax was created. The new prices are:

	Lire
Carbon-filament lamps each	1.60
Metallic-filament lamps of whatever type:	
Up to 60 cp. each	3.00
From 65 to 250 cp. each	6.00
From 250 to 900 cp. each	16.00
Of 1,000 cp. and greater, each	24.00

The value of the lira on Feb. 13 was 17.72 to the dollar.

FREE IMPORTATION INTO POLAND OF SOME ELECTRICAL GOODS.—The most recent regulations permit entry into Poland without special license of electrical articles for installation (except chandeliers, lamps and shades), incandescent lamp bulbs and hand flashlights, cables and insulated wire.

NEW ZEALAND'S INCREASING TRADE IN ELECTRICAL IMPORTS FROM JAPAN.—During the years 1915, 1916, 1917 and 1918 New Zealand imported from Japan electrical machinery in the following respective amounts: $12,784, $63,575, $73,688 and $188,980.

ITALIAN INVESTMENTS IN ELECTRICAL INDUSTRIES INCREASE.—During the year 1917 investments in Italian industries embracing electrical operation and supplies amounted to 191,000,000 lire, while during 1918 the investment almost doubled to just under 359,000,000 lire. This investment was surpassed by only one other industry, that of the manufacture of metals. The difficulties of obtaining supplies from abroad account for this progress in the electrical industries. Recently organized companies in Bologna will manufacture hydro-electric and traction supplies and storage batteries.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The electrical commissioners in a city in Australia (No. 30,856) desire to receive quotations and full information for the purchase of boiler-house machinery, including boilers, economizers, etc., coal and ash handling machinery, turbo-generators, condensing plants, electrical storage batteries, traveling cranes, electrical instruments, switch gear, switches and all accessories, synchronous condensers and water turbines for direct coupling to generators. Description of machinery and equipment required may be had on application to the bureau or its district offices.

A firm in England (No. 31,394) having a branch office in the United States desires to be placed in touch with manufacturers of electrical labor-saving appliances, with a view to their sale in England. It is particularly interested in washing machines, vacuum cleaners, dish-washing machines, electrical clothes dryers, motor-driven sewing machines, and electrical water heating apparatus. Articles of the highest class, and in large quantities are wanted.

A company in Honduras (No. 31,396) desires to purchase machinery for an ice plant, capable of producing 3,500 lb. of ice per day. Quotations wanted on electric machinery, f. o. b. New York, or preferably San Francisco. Payment, one-third cash with order, balance by drafts of equal amounts, 90 days, 120 days, and six months from date of shipment. Correspondence may be in English. Complete information should be furnished with first communication.

A firm specializing in American electrical manufactures in England (No. 31,496) desires to secure an agency or purchase electrical machinery and control gear, motors and generators, alternating and direct current; will purchase if agency is unobtainable.

An electrical engineer in Argentina (No. 31,662) desires to purchase electrical machinery, motors, generators, etc., for medium-power electric plants (100 hp. to 200 hp.), and requests immediately catalogs giving detailed specifications.

A firm of manufacturers in Spain (No. 31,689) desires to secure the sole agency on commission for the sale of electrical machinery and supplies and electric flatirons.

A commercial agent in the West Indies (No. 31,690) desires to purchase a small ice-making plant of a maximum capacity of 3 tons, preferably combined with electric lighting plant sufficient for 250 16-cp. lamps.

An American exporting house (No. 31,503), which has established branches in all the principal cities of the Levant and maintains showrooms, warehouses and service stations, desires to represent American firms for the sale of electrical apparatus.

An agency is desired by a firm in Switzerland (No. 31,516) for the sale of stationary motors driven by electricity, horizontal, 20 hp. to 120 hp., and compressors, cranes and rigs.

An importer in Belgium (No. 31,519) desires to secure an exclusive agency for the sale of electrical and electro-mechanical products of all sorts.

An agency is desired by a man in Italy (No. 31,709) for the sale of electric lamps, electrical supplies and novelties.

New Incorporations

THE TRENTON LIGHT & POWER COMPANY of Fox Lake, Wis., has been incorporated by C. J. Schoenfeld and others. The company is capitalized at $15,000 and proposes to generate and distribute electricity for lamps and motors.

THE GILBERT (IOWA) ELECTRIC COMPANY has been incorporated with a capital stock of $15,000 to supply electricity for lamps and motors in Gilbert. John Hill is president of the company.

THE UNION POWER COMPANY of Mullens, W. Va., has been chartered with a capital stock of $25,000 by Harrison B. Smith, Duke W. Hill and David C. Howard, all of Charleston, W. Va.

THE BLANCHARD (OKLA.) MILL & POWER COMPANY has been chartered with a capital stock of $25,000 by Thomas C. Dyer, H. C. Freeney and A. O. Maddox, all of Blanchard.

THE GILBERT (S. C.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $3,000 to install an electric plant in Gilbert. K. B. Price is engineer and manager.

THE CENTRAL POWER COMPANY of Geneva, Ala., has been incorporated with a capital stock of $150,000 to develop a water-power project.

THE LAUREL HILL ELECTRIC COMPANY of Laurel, N. C., has been incorporated by G. McN. Pate, Z. V. Edwin and others. The company is capitalized at $25,000 to operate an electric light and power plant in Laurel.

Trade Publications

HANGER OUTLET.—The Frank Adam Electric Company, St. Louis, Mo., has put out a folder describing a flush outlet on which an electric fan may be hung.

HANGERS.—In catalog B-18 The Thompson Electric Company, Cleveland, Ohio, tells how to use reflectors with Thompson safety disconnecting hangers.

FIXTURES.—Catalog No. 5 of the Reflectolyte Company, St. Louis, Mo., is now being distributed.

STOKERS.—In publication No. 30 the Sanford-Riley Stoker Company of Worcester, Mass., describes its stokers from the standpoint of adaptability.

PLASTIC MOLDING.—A booklet giving information on plastic insulating compounds and suggestions on molding them has been prepared by the Shaw Insulator Company, 5 Kirk Place, Newark, N. J.

TRANSMISSION-LINE EQUIPMENT.—Hickey & Schneider, Inc., 439 Jersey Street, Elizabeth, N. J., have issued bulletin No. 15 describing transmission-line and station equipment.

OIL PURIFYING.—The De Laval Separator Company, 165 Broadway, New York City, and 29 East Madison Street, Chicago, has issued several booklets on the De Laval method of purifying and reclaiming lubricating, cutting, hardening and fuel oils, by the use of motor-driven separators.

OIL ENGINES.—The Allis-Chalmers Manufacturing Company of Milwaukee, Wis., has issued bulletin No. 1537 giving details of its Diesel type oil engine, to assist in ordering repairs and spare parts.

MOLDED MATERIAL.—The Belden Manufacturing Company, Twenty-third Street and Western Avenue, has issued buletin No. 1208 on Beldenmold molded pieces made from "Condensite," "Bakelite" and "Redmanol".

GALVANOMETERS.—"Paul" Uniproof galvanometers are the subject of bulletin No. 100 recently issued by the Rawson Electrical Instrument Company, Central Square, Cambridge, Mass.

RECTIFIERS.—The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., is circulating bulletin A on its type M U alternating-current battery charger.

INSTRUMENTS.—Herman H. Stich & Company, 15 Park Row, New York City, have prepared bulletin 105 (AA) on their "Monopivot" galvanometers, micro-ammeters, milli-voltmeters and milli-ammeters.

New England States

SKOWHEGAN, ME.—It is reported that the Central Maine Power Company is planning the construction of large power house which will have five water turbines, one of which, it is stated, will generate more power than is at present produced in Skowhegan.

WINDHAM, ME.—The Newhall plant of the E. I. du Pont de Nemours Company which has been destroyed by fire will be rebuilt in the immediate future. The new building will be operated by electric power.

SPRINGFIELD, MASS.—The Cheney Bigelow Wire Works has completed arrangements for the construction of the proposed new one and two-story brick addition to its plant, about 45 ft. x 450 ft., to be located at Warwick and Heywood Streets. Contract for the structure, which is estimated to cost about $100,000, has been awarded to L. S. Wood, 14 Stockbridge Street, Springfield.

SPRINGFIELD, MASS.—Plans have been prepared by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., for the erection of a large new one-story concrete and steel machine shop to be located in the East Springfield, Mass., section. The new structure, with machinery and equipment, is estimated to cost approximately $400,000. Bernard Prack, Keystone Building, Pittsburgh, is architect.

HARTFORD, CONN.—Contract has been let to the Stone & Webster Engineering Corporation, Boston, Mass., by the Hartford Electric Light Company for the erection of the proposed new power station, to be located in the south meadows district. It is proposed to construct the plant on the unit plan to comprise two units, the first section being three-story, about 200 ft. in length, of brick, concrete and steel. The second section will be constructed at a later date.

NEW HAVEN, CONN.—Notice of an increase in the capital of the Acme Wire Company, 973 Dixwell Avenue, from $1,500,000 to $3,000,000, for general business expansion, has been filed with the Secretary of State. The company specializes in the production of electromagnets, magnet wire, and allied products.

Middle Atlantic States

FILLMORE, N. Y.—The water rights of Wiscoy Falls have been purchased by the Genesee Valley Power Company. It is reported that they will extend the present line to Belfast, Belmont and Angelica, and develop an additional 600 hp.

FREEPORT, N. Y.—Plans for improving the municipal lighting plant include the retubing of two of the power house boilers and replacing the present steam engines with oil engines.

MEDINA, N. Y.—The Western New York Utilities Company, Inc., has had plans prepared for the erection of a new electric light and power plant at Clarendon, Orleans County. The company has been granted permission by the Public Service Commission, Albany, to proceed with the work.

NEW YORK, N. Y.—Plans are under consideration by Edwards & Company, Exterior Avenue and One Hundred and Fortieth Street, manufacturer of electrical products, for the erection of a new addition to its plant for increased operations. The structure will be two-story, brick and concrete, about 60 ft. x 95 ft.

NEW YORK, N. Y.—A new boiler plant to provide for increased power facilities, will be erected at the Fordham Hospital, Crotona Avenue and Southern Boulevard. Plans for the structure are being prepared by the Board of Trustees of Bellevue & Allied Hospitals, 415 East Twenty-sixth Street.

ROME, N. Y.—In connection with the proposed expansion plans of the Rome Wire Company to include the operation of the plant of J. J. Carrick, Inc., Clyde Avenue, near Kensington Avenue, Buffalo, N. Y., formerly used for the manufacture of shells, recently acquired, contract has been awarded to the John W. Cowper Company, Inc., Fidelity Building, Buffalo, for remodeling and improving the works to suit the new line of manufacture, as well as for the construction of two new one-story additions, 120 ft. x 240 ft., and 100 ft. x 280 ft., respectively, to cost about $250,000. A building to be used for office purposes will also be erected. The plant will be devoted to the production of insulated wire. H. T. Dyett is president.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

SCHENECTADY, N. Y.—The Mica Insulator Company, 68 Church Street, New York, will build a large new addition to its local plant. Plans are being arranged for the construction of a three-story reinforced concrete building, estimated to cost about $150,000, to provide for increased capacity. The company's plant is devoted to the production of insulation specialties. W. L. Stoddard, 9 East Fortieth Street, New York, is architect.

WATERTOWN, N. Y.—The Beebbe Island Syndicate is understood to have commissioned J. G. White & Company, Inc., 43 Exchange Place, New York, to prepare preliminary plans for the erection of a large new hydroelectric plant on Beebe Island, near Watertown. The proposed station is estimated to involve an expenditure of about $1,000,000.

EAST ORANGE, N. J.—Plans are being arranged by the City Council for the installation of a new electric street-lighting system in Main Street and Central Avenue.

NEWARK, N. J.—The Independent Lamp & Wire Company, Inc., 1733 Broadway, New York, with plant at Weehawken, N. J., is planning for the early construction of the proposed new plant to be located on property bounded by Runyon Street, Hillside and Belmont Avenues, Newark.

OLDWICK, N. J.—Plans are under consideration by the Borough Council for the immediate installation of a new electric street-lighting system throughout the municipality.

READINGTON, N. J.—The Readington Township Committee has under contemplation the installation of a new electric street-lighting system in the Three Bridges section, including the establishment of an electric plant to be located in the Rockefeller Mills property.

TRENTON, N. J.—The Blabely Laundry Company, 11 South Warren Street, will build a new laundry plant at Brunswick Avenue and North Montgomery Street, estimated to cost $100,000. Considerable electrical and mechanical equipment will be required for the works, which will be one-story, about 85 ft. x 180 ft. Contract has been let to the N. A. K. Bugbee Company, 206 East Hanover Street.

CHESTER, PA.—Considerable refrigerating apparatus and electrical equipment will be required in connection with the construction of the proposed new local ice-manufacturing plant of the W. F. Koelle Company, Twenty-sixth and Oxford Streets, Philadelphia, Pa., contract for which has been awarded. The new plant will have a capacity of 60 tons, and will be about 85 ft. x 130 ft.; it is estimated to cost $200,000, including equipment.

CLEARFIELD, PA.—The Penn Public Service Corporation is arranging plans to increase the capacity of its generating plant at Rockwood. The company is also planning for the formation of a subsidiary organization, which latter company will purchase a large tract of property in the vicinity of Seward, Pa., to be used as a site for a new power station. The proposed new station will have an initial capacity of 30,000 kw., to be increased at a later date to 80,000 kw. The Penn Company recently completed plans for the issuance of bonds for $4,000,000, to be used for proposed expansion.

PHILADELPHIA, PA.—A new one-story brick and concrete power plant and engine house will be erected at the plant of Charles E. Dearnley, at Bayton Street and Chelten Avenue. The structure will be about 36 ft. x 90 ft.

PHILADELPHIA, PA.—Contract has been awarded to the Philadelphia Electric Company for the furnishing of electric service to the townships of Cheltenham and Springfield.

POTTSTOWN, PA.—Sotter Brothers, Inc., manufacturer of boilers, stacks, etc., will build a large new addition to its plant for increased operations. Contract for the works has been let to the McClintic-Marshall Company, Pittsburgh. The proposed addition will be one-story, about 95 ft. x 120 ft., and is estimated to cost about $100,000, including machinery and equipment. H. M. Lessig is president.

READING, PA.—The Metropolitan Edison Company is making rapid progress on the construction of its new 66,000-volt high-tension transmission line to Pottsville, approximately 36 miles. The company plans to use the line for furnishing electric energy to the upper Schuylkill River valley and the lower anthracite region in this vicinity, and in connection with the work two new transformer stations will be erected at Hamburg, about 18 miles from Reading.

ELKTON, MD.—The Perryville Electric Company has arranged for the disposal of its local plant and property to the Havre de Grace Electric Company. The new owner will continue the operation of the plant.

FREDERICK, MD.—The Farmers' Association is considering plans for the immediate construction of a new local hydroelectric plant, to be devoted to electric energy for local business interests.

HAGERSTOWN, MD.—Plans are being arranged by the Street Commissioners for a bond issue of $300,000, the proceeds to be used for the construction of a new municipal electric plant on Antietam Creek.

NORFOLK, VA.—A three-story fireproof brick and concrete building is to be erected by the Automatic Soda Fountain Corporation which was recently chartered with a capital of $500,000. The building will be 100 ft. x 100 ft. and with the necessary equipment will cost about $75,000.

PETERSBURG, VA.—The Petersburg Silk Hosiery Corporation, recently organized with a capital of $500,000, is planning to install 42 electrically driven knitting machines with a daily capacity of 1,800 doz. pairs of silk hose. The cost is estimated at $300,000.

WARRENTOWN, W. VA.—Improvements being considered by the Warrentown Electric Light & Power Company include the installation of a 90-kw., 60-cycle, 2,200-volt generator, and a 150-hp. boiler, and the erection of 5 miles of transmission lines and street lighting system. M. J. O'Connell is the secretary-manager.

North Central States

LANSING, MICH.—It is reported that an additional municipal electric light and power plant is to be constructed at a cost of about $2,000,000 to satisfy the power demands made by local industrial expansion.

SAGINAW, MICH.—It is reported that as soon as a $6,000,000 bond issue is authorized by the state securities commission, the Consumers' Power Company will put into execution plans for the construction of a steam electric generating plant at Milwaukee. The project is estimated to cost $5,000,000 and is made necessary by repeated demands for increased power all through that vicinity.

CARROLLTON, KY.—Plans are being made for the construction of an electric light and power plant to cost $32,184. The contractors are Frazier & Morrell of Lexington, Ky., the engineer, J. H. Brock of the same city.

DAWSON SPRINGS, KY.—It is reported that nineteen additional buildings of the United States Public Health Sanitarium are to be equipped with power plants and mechanical equipment, for which the Treasury Department at Washingotn has appropriated $381,530. S. W. Rittenhouse, contractor, of Washington, D. C., is in charge of the work.

HAZARD, KY.—Contemplated additions to the steam generating plant of the Kentucky & West Virginia Power Company include the installation of a 3,000-kw. turbine with surface condenser, two new 800-hp. boilers, underfeed stokers and auxiliary operating equipment.

MAYKING, KY.—A new power plant is to be added to the plant of the Pine Creek Coal Company.

COLUMBIA CITY, IND.—In order that their farms may be supplied with electric lights and power, the farmers in this vicinity have organized a light and power com-

pany which will supply current only to members. Work on the plant, which is to be situated on the Eel River, is already under way. C. M. Koontz is president of the association.

ELWOOD, IND.—The Pittsburgh Plate Glass Company will expend $100,000 for new factory buildings.

HAMMOND, IND.—The La Salle Steel Company will erect a new plant in Hammand to employ between 800 and 1,000 men. The new buildings will be of steel, glass and concrete.

LOGANSPORT, IND.—Ward Brown and J. W. Sherrick of Indianapolis, owners of the Barnett Hotel, which was recently destroyed by fire, are working on plans to erect a $500,000 hotel for this city.

MUNCIE, IND.—The Big Four Railroad Company will award contract March 1 for a two-story reinforced concrete freight house, to cost $150,000.

CHICAGO, ILL.—Plans are being considered to completely reorganize the city's present lighting system. The project as planned would necessitate a bond issue of $15,000,000.

EAST ST. LOUIS, ILL.—The Railroad Administration is planning the construction of a steel transfer barge to handle freight by the Mississippi River barges and connecting railroads. The barge, which will be able to take care of 20,000 tons of freight each week, will be electrically operated. The contract for construction has been awarded to the Dubuque Boat & Boiler Works of Dubuque, Iowa.

EL PASO, ILL.—The El Paso Telephone Company plans to rebuild its line this season. Most of the cable will be installed underground.

EVANSTON, ILL.—The Davis Hotel, to cost $1,800,000, will be erected by Henry T. Davis.

TRACY, MINN.—In order to meet the ever-increasing demands for electric power, the Citizens' Light, Heat & Power Company is planning to double the generating capacity of its plant by installing a new 365-hp. Diesel engine direct connected to a 2,300-volt generator, at an estimated cost of $50,000. Emil W. Erick is the president.

DAVENPORT, IOWA. — The Nelson Manufacturing Company of St. Louis will erect a four-story reinforced concrete warehouse, 96 ft. x 140 ft., to cost $175,000.

GREENFIELD, MO.—A new system to connect with Osceola is being contemplated by the Greenfield Light & Power Company of which Colin K. Lee is the superintendent. The probable cost is set at $35,000.

INDEPENDENCE, MO.—The City Council has under consideration plans for improving the municipal electric lighting plant. The new equipment to be installed at a cost of about $60,000, includes engine, generator and auxiliary equipment.

KANSAS CITY, MO.—The Kansas City Telephone Company will install 10,000 automatic telephones this year. The general offices will be removed in April to the new building at Eleventh and Oak Streets. Following the installation of the first 10,000 automatics, the equipment in the entire city will be changed to that type. The final elimination of the present manual system will not take place for about seven years, according to estimates of the company.

KANSAS CITY, MO.—Plans are being prepared for the erection of a $1,750,000 interurban station to be erected by various interurban companies operating in the vicinty of Kansas City.

Southern States

BENSON, N. C.—Bonds to the amount of $50,000 have been issued for the construction of an electric light plant. L. Gilbert is the clerk.

CHARLOTTE, N. C.—A six-story fireproof garage of reinforced steel and concrete is to be built by C. C. Coddington. The building will be 90 ft. x 198 ft. and will have 100,000 sq.ft. of floor space. Equipment to be installed includes two freight and one passenger elevator, a water-cooling system, steam-heating plant, compressed-air chutes, and a repair shop, the total cost approximating $350,000. Albert Kahn, of Detroit, Mich., is the architect.

GASTONIA, N. C.—The Loray Mills, manufacturers of sheetings, etc., are planning to spend $1,000,000 in improving and enlarging their plant. The steam and big electric motors and drives are to be replaced by small motors each driving small sections of the machinery; the number of spindles will be increased from 57,000 to 90,000; and 150 bungalows will be built for operatives, together with dormitories, barber shops, locker rooms, cafeteria and a laundry.

HERTFORD, N. C.—The plant of the Major & Loomis Lumber Company has been destroyed by fire at an estimated loss of $150,000.

KINSTON, N. C.—The city is planning to spend $125,000 in improvements to the electric light plant under the direction of W. C. Olsen, consulting engineer, of Sumter, S. C. Jos G. Dawson is the mayor.

MOUNT HOLLY, N. C.—The capital of the Catawba Spinning Company has been increased from $200,000 to $500,000, and the company plans to build a two-story addition, 190 ft. x 75 ft., and install 6,000 additional spindles.

NEWBERRY, S. C.—The city has under consideration plans for installing a municipal electric light plant. Eugene S. Blease is the mayor.

ALMA, GA.—The city has under consideration the construction of an electric lighting system. The present plans call for a 50-hp. oil engine, a 37½-kva. generator, a pole line, etc. A. B. Mercer is the mayor; the engineer in charge is J. B. McCrary Company of Atlanta, Ga.

ATLANTA, GA.—Extensive improvements contemplated by the Johnson Paint Company include the erection of a brick and tile fireproof factory, 140 ft. x 100 ft., at a cost of $100,000, and the installation of stone mills, mixers, grinders, electric elevators, heating plants, etc. The contractor is Hard & Adams.

ROME, GA.—An additional 85,000 sq.ft. of brick and concrete is to be added to the plant of the Anchor Duck Mills, maunfacturing cotton duck. The new plant, to cost about $200,000, will be run by electric power. J. A. Glover is president; J. F. Dupre Sons Company, contractor.

CEDAR KEYS, FLA.—L. A. Toler has under consideration the installation of an electric light plant and the construction of a one-mile transmission system.

PALATKA, FLA.—The city is contemplating the installation of a white way lighting system of approximately 100 lamps. J. H. Randolph, city engineer, will be glad to receive communications from manufacturers with reference to this proposition.

SARASOTA, FLA.—It is reported that bonds will be issued amounting to $35,000, to cover the cost of improvements and extensions to the municipal electric light and power plant.

VERO, FLA.—Bonds to the amount of $30,000 have been voted by the city, the proceeds to be used in enlarging the electric light plant.

CHATTANOOGA, TENN.—The Turner Construction Company of New York is building a reinforced concrete three-story mill, 312 ft. x 132 ft., and a two-story warehouse, 116 ft. x 62 ft., for the Thatcher Spinning Company, manufacturer of hosiery yarn. The new machinery is to be electric driven, and 30,000 additional spindles are to be installed as well as fire-protective apparatus. H. S. Thatcher is the secretary-treasurer.

BIRMINGHAM, ALA.—The Chickasaw Shipbuilding & Car Company, which is a subsidiary of the United States Steel Corporation is planning to spend several million dollars in building a plant for the manufacture of steel cars and steel frames.

BIRMINGHAM, ALA.—Charles R. Reid, president of the Baker-Reid Lumber Company, is planning to install a planing mill with a monthly capacity of 150 carloads. The new mill will cost about $50,000 and will be run by electricity.

SELMA, ALA.—The Vredenburg Lumber Company is planning to rebuild the mill which was recently burned at a loss of $150,000.

CLARKSDALE, MISS.—The city is considering a bond issue of $500,000 to cover the cost of city improvements to the light, water and street systems.

LITTLE ROCK, ARK.—Bonds for $375,000 have been issued to cover the cost of improvements and extensions to the power plant of the Little Rock Railway & Electric Company in accordance with its plans for increased capacity. Boilers and other new equipment will be installed.

SELMA, LA.—It is reported that the Grant Timber & Manufacturing Company, dealers in pine and hardwood, are planning to install two sawmills with a combined daily output of 150,000 ft., at an estimated cost of $200,000. Thrall & Shea, of Lake Charles, La., are the contractors.

HOUSTON, TEX.—W. H. Irvin is planning to double the capacity of his ice plant and candy factory which has a daily capacity of 50 tons, and increasing his storage capacity to 5,000 tons by an addition that will cost approximately $400,000.

NAVASOTA, TEX.—A new power plant to cost, together with the necessary equipment, about $60,000, and with a capacity of 250 hp. is to be constructed under the direction of the Chamber of Commerce.

SLATON, TEX.—A franchise for the installation and operation of an electric light and power plant has been granted to Lewis H. Fuller with the proviso that the plant shall be in operation by June 14, 1920.

Pacific and Mountain States

CENTRALIA, WASH.—Surveys are being made by the Sherman County Light & Power Company for a new steam-electric power plant. The total estimated cost is given as $500,000.

OLYMPIA, WASH.—The city is considering the installation of cluster lights in the downtown district, at a cost of $20,000 to $25,000.

VANCOUVER, WASH.—It is reported the Northwestern Electric Company plans the construction of a huge electric power project to cost possibly $5,000,000. G. C. Pierce, vice-president and general manager, announces that the company has crews making preliminary surveys of the north fork of the Lewis River, where water will be dammed and the power house erected.

WENATCHEE, WASH.—The Wenatchee Valley Gas & Electric Company, through Receiver R. T. Lovell, has let a contract for the construction of a concrete building, 40 ft. x 60 ft. in size, adjoining the gas plant operated by the company here. This will be used to house the new steam generating station, with capacity of 1,000 hp., which is expected to be in operation by April 1. The total cost of the new plant is placed at $80,000.

PORTLAND, ORE.—The North Portland Box Company is planning to rebuild their power plant which was recently destroyed by fire at an estimated loss of $25,000.

PORTLAND, ORE.—A new power plant to cost in the neighborhood of $800,000 will be constructed by the Pacific Power & Light Company at Young's Bay, where a site of about 15 acres has been obtained.

PORTLAND, ORE.—E. G. Hopson, engineer, 205 Central Building, Portland, has filed application with the State Engineer at Salem, to take 1,400 second feet of water from the Metolius River in Crook County for commercial power and light purposes. The concern will construct a dam 50 ft. high and 500 ft. long at the top, of cyclopean concrete, the headgate and semi-circular canal also to be of concrete. Turbines will be connected with electric generators and a fall of 140 ft. is expected to develop 18,000 theoretical horsepower. The cost of the project is placed at $1,300,000. It is expected work will begin immediately after enactment of federal legislation now pending permitting utilization of power on public lands. Mr. Hopson has also filed application to take 1,200 second-ft. of water from the Metolius River in Crook County for commercial light and power. The dam here will be 20 ft. high and 650 ft. long, built of rockfill and concrete with headgate and circular canal of the same material. It is expected 43,000 hp. will be generated.

SALEM, ORE.—Farmers in the surrounding country are petitioning the Portland Railway, Light & Power Company to extend its lines so that their farms may be electrically lighted.

BAKERSFIELD, CAL.—The San Joaquin Light & Power Corporation has under consideration the construction of a new plant approximately 35 miles west of Bakersfield. The first unit is to be erected immediately at a cost of approximately $1,000,000, and will furnish 17,500 hp.. The new plant will be run by natural gas which is now going to waste and when completed will have a generating capacity of 75,000 hp. The estimated cost of the entire project is $6,000,000.

FILLMORE, CAL.—Surveys are being made for a large electric power plant to be constructed by the Sespe Light & Power Company. Frank Lock is the engineer in charge.

HOLTVILLE, CAL.—It is reported that the Holton Power Company is contemplating the construction of several new hydro-electric plants in southern California as well as other improvements for which a total of $1,500,000 has been allotted. It is also reported that another appropriation of $200,000 has been made by the same company for the purpose of constructing a

power line in the Palo Verde Valley to Blythe and Ripley.

OAKDALE, CAL.—The Pacific Gas & Electric Company, which has recently leased the Sierra & San Francisco Power Company, is contemplating the construction of a new reservoir at Stanislaus to cost about $1,000,000. It is reported that work on this undertaking will be begun at once.

REDDING, CAL.—The Pit River Power Company is planning to build a power plant which, with its equipment, will cost over $10,000,000. Surveys for the project have been completed in the vicinity of Copper City.

STOCKTON, CAL.—The Western States Gas & Electric Company has petitioned the California Commission for authority to issue preferred stock of par value of $603,000 in order that the company may carry out its construction plans for 1920.

WESTWOOD, CAL.—Owing to the fuel shortage, the Red River Lumber Company is planning to build a hydro-electric plant on Feather River, with a generating capacity of about 4,000 kw. to be used in driving the machinery of the company's sawmills.

OGDEN, UTAH—The city has under consideration the construction of a municipal electric light plant. The possible sites for the plant are in South Fork Canyon. Frank Francis is the mayor.

TUCSON, ARIZ.—Plans are under consideration for installing a local electrical plant either on a co-operative basis or as a municipal project.

Canada

EDMONTON, ALTA.—The Utilities Committee have under consideration additions to the power house which are estimated to cost $200,000. C. E. K. Cox is the city clerk.

BRANTFORD, ONT. — The Dominion Steel Products Company is planning to build a foundry at an estimated cost of $150,000.

REGINA, SASK.—It is reported that a theatre is to be built by the Trans-Canada Theatres, Ltd., at an approximate cost of $250,000.

Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 3, 1920.)

14,798. SWAGING MACHINE; Thomas A. Edison, West Orange, N. J. App. filed Jan. 21, 1919. Manufacture of styli for phonograph records.

1,329,384. ELECTRODE HOLDER; Louis A. Eckenrode, Chambersburg, Pa. App. filed April 25, 1919. Avoids fusion and current losses.

1,329,413. METHOD OF JOINING STRUCTURAL STEEL MEMBERS BY ELECTRIC WELDING; Charles H. Kicklighter, Atlanta, Ga. App. filed Sept. 18, 1919. Light portable welder for crane operation.

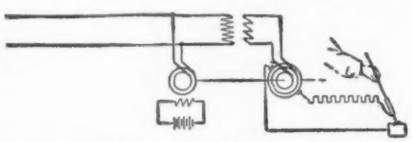
1,329,432. METHOD OF AND APPARATUS FOR FAULT LOCATION ON ELECTRICAL CONDUCTORS; Clarence E. Rogers, Oakland, Cal. App. filed June 11, 1917. Slide-wire Wheatstone bridge for wires having unlike resistances per unit of length.

1,329,448. ELECTRICAL COUPLING; Adolf von Post, London, Eng. App. filed April 5, 1916. Plug for connection beneath table.

1,329,488. ELECTRICAL HEATING SYSTEM; William Whelan, St. Joseph, Mo. App. filed Aug. 17, 1918. For boilers supplying steam or hot water for houses.

1,329,508. IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES; Arthur O. Dady, New York, N. Y. App. filed July 27, 1917. Either magneto or battery current for ignition.

1,329,520. MACHINE FOR ELECTRICALLY WELDING THE CALK OR TOE-PIECE UPON HORSESHOE BLANKS; Cyrus M. Garvin, Pittsburgh, Pa. App. filed May 18, 1915. Uses transformer and induction coil.



No. 1,329,532—Arc Welder Apparatus

1,329,530. ARC-WELDING ELECTRODE; Robert E. Kinkead, Cleveland, Ohio. App. filed Nov. 1, 1919. Electrode to supply iron vapor for arc maintenance during puddling.

1,329,532. ARC-WELDER APPARATUS; James F. Lincoln, Cleveland, Ohio. App. filed Oct. 30, 1918. Single-phase rectified current supply with non-inductive resistance for arc circuit to repair sheet and cast metals.

1,329,555. ELECTRICAL PLUG; Webb L. Smith, San Francisco, Cal. App. filed Aug. 30, 1918. Permits cord to twist.

1,329,557. GERMICIDE ATTACHMENT FOR TELEPHONES; John A. Stransky, Pukwana, S. D. App. filed Feb. 20, 1919. Antiseptic tablet held laterally on inner face of diaphragm and within mouthpiece.

1,329,592. ATTACHMENT PLUG FOR ELECTRIC HEATING DEVICES; William N. Furthmann, Chicago, Ill. App. filed April 19, 1919. Adaptable to all forms of contact prongs or fingers.

1,329,630. METHOD OF INSULATING WIRE; John J. Reinhold, Marietta, Pa. App. filed Jan. 9, 1917. Asbestos-covered wire, rolled, pressed and coated.

1,329,639. LIGHT SIGNAL; Clarence S. Snavely, Edgewood Borough, Pa. App. filed Nov. 19, 1915. Filament occupies predetermined position with relation to lamp bulb.

1,329,640. ADJUSTMENT OF INCANDESCENT LAMPS; Clarence S. Snavely, Pittsburgh, Pa. App. filed Nov. 19, 1915. Applying heat to render filament movable with respect to bulb.

1,329,654. IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES; Arthur O. Dady, New York, N. Y. App. filed July 27, 1917. Efficient spark at low engine speeds.

1,329,656. INSULATOR; Arthur H. Fargo, Poughkeepsie, N. Y. App. filed April 3, 1914. Knob insulator loosely assembled and ready for use.

1,329,658. TELEPHONE HEADBAND; Hugo Gernsback, New York, N. Y. App. filed April 21, 1917. Adjustable headband without spring clamps.

1,329,672. WIRELESS SIGNAL-RECEIVING APPARATUS; Ernest C. Mignon, Elmira, N. Y. App. filed Nov. 29, 1916. Inductances providing practicably non-leaking magnetic fields.

1,329,688. TELEVISION AND TELEPHOTOGRAPHIC APPARATUS; André D. Voulgré, Bayonne, France. App. filed April 1, 1916. Transmits luminous impressions.

1,329,733. MAGNETIC CHUCK; Oakley S. Walker, Worcester, Mass. App. filed March 8, 1919. For small pieces of work.

1,329,758. OSCILLATING-CURRENT GENERATOR; Lee de Forest, New York, N. Y. App. filed March 26, 1915. Hollow grid-shaped electrode interposed between hot and plate electrodes in vacuum.

1,329,761. ELECTROLYTIC OSCILLATOR; Edward G. Gage, South Norwalk, Conn. App. filed July 13, 1917. For radiotelegraphy or radio-telephony.

1,329,770. INSULATOR; Robert M. Johnston, Detroit, Mich. App. filed Jan. 11, 1916. Prevents deterioration from excessive dielectric stress and from differences in coefficient of expansion of metal parts and of insulating material.

1,329,780. POWER-TRANSMITTING APPARATUS; Justin Lebovici, Oakley, Ohio. App. filed Sept. 13, 1917. Automobile transmission system adjusted electromagnetically.

1,329,799. CONTROL SYSTEM FOR RECTIFIERS; Henry K. Sandell, Chicago, Ill. App. filed Sept. 11, 1916. For synchronously driven commutating rectifier for charging batteries.

1,329,842. MEANS FOR NEUTRALIZING INTERFERENCE; William H. Martin, New York, N. Y. App. filed Feb. 28, 1919. Obtained by varying magnitude of impedance.

1,329,890. WELDING MACHINE; Amédée G. F. Fargues, Lyons, France. App. filed May 9, 1918. Forms T-joints.

1,329,892. PROJECTION APPARATUS; Howard T. Flanigan, Buffalo, N. Y. App. filed June 24, 1916. Carbons mounted at angle to one another.

1,329,897. DEVICE FOR TAKING A REGULABLE CONSTANT CONTINUOUS CURRENT FROM AN ALTERNATING-CURRENT LINE; Heinrich Greinacher, Zurich, Switzerland. App. filed Feb. 5, 1919. Closing alternating-current circuit with adjustable-resistance rectifier and condenser.

1,329,905. TELEGRAPH SOUNDER; John W. Jackson, Henryetta, Okla. App. filed May 21, 1919. Dispenses with local battery and extra sounder magnets at each station.

1,329,917. STORAGE BATTERY; Paul M. Marko, Brooklyn, N. Y. App. filed March 14, 1918. Cover and level indicator for electrolyte.

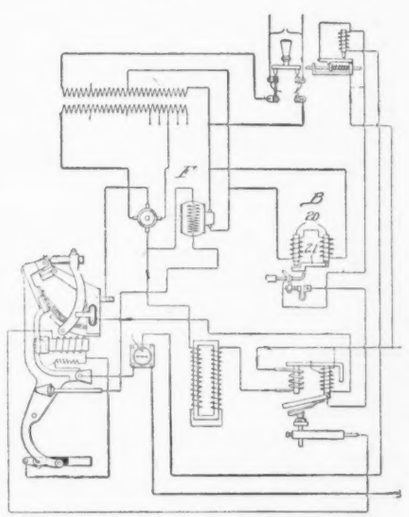
1,329,926. INDUCTOR-ALTERNATOR; Henry J. Podlesak, Chicago, Ill. App. filed Dec. 16, 1916. Rapid diverting of magnetic flux through unwound polar projections.

1,329,928. SOUND-MAGNIFYING PHONOGRAPH; Edwin S. Pridham and Peter L. Jensen, Napa, Cal. App. filed July 3, 1916. Combination with sound box of talking machine, microphone transmitter and sound amplifier.

1,329,942. ADJUSTABLE RECEIVER HOLDER; Adele Weiss and Emanuel Weiss, Pasadena, Cal. App. filed Dec. 5, 1918. Wall support with pivoted receiver arm.

1,329,946. ELECTRIC BATTERY; Harry D. Batchelor, Lakewood, Ohio. App. filed June 13, 1919. Dry reserve cells.

1,329,949. ELECTRICAL MEASURING APPARATUS; Otto B. Blackwell, Garden City, N. Y. App. filed March 4, 1918. For measuring effective inductance and effective resistance.



No. 1,329,799—Control System for Rectifiers

1,330,019. MEASURED-SERVICE TELEPHONE SYSTEM; John Erickson, Chicago, Ill. App. filed June 7, 1916. Maximum-time signal notifies user that additional toll will be collected.

1,330,021. DYNAMO-ELECTRIC MACHINE; Hayner H. Gordon, Washington, D. C. App. filed Dec. 12, 1916. Windings of magneto continuously connected to the spark plugs of engine.

1,330,037. ELECTRIC GENERATOR; Leon J. Le Pontois, Lakewood, Ohio. App. filed Oct. 14, 1914. Magneto a part of engine case to economize space and weight.

1,330,038. ELECTRIC GENERATOR; Leon J. Le Pontois, Lakewood, Ohio. App. filed Oct. 14, 1914. Utilizing flux of permanent magnet for ignition purposes.

1,330,039. ELECTRIC GENERATOR; Leon J. Le Pontois, Lakewood, Ohio. App. filed Oct. 26, 1914. Dispenses with additional gearing.

1,330,046. TELEPHONE APPARATUS AND SYSTEM; Edward A. Mellinger, Chicago, Ill. App. filed March 26, 1907. Step-by-step-actuated switching machines for extending connection called subscriber.